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56TH CONGRESS, 2d Session. } SENATE. { DOCUMENT No. 39.

MESSAGE

FROM THE

PRESIDENT OF THE UNITED STATES,

TRANSMITTING

A COMMUNICATION FROM THE SECRETARY OF STATE, FORWARDING THE REPORT OF THE UNITED STATES COMMISSIONER TO THE INTERNATIONAL FISHERIES EXHIBITION OF 1898 AT BERGEN, NORWAY.

DECEMBER 11, 1900.—Read, referred to the Committee on Fisheries, and ordered to be printed.

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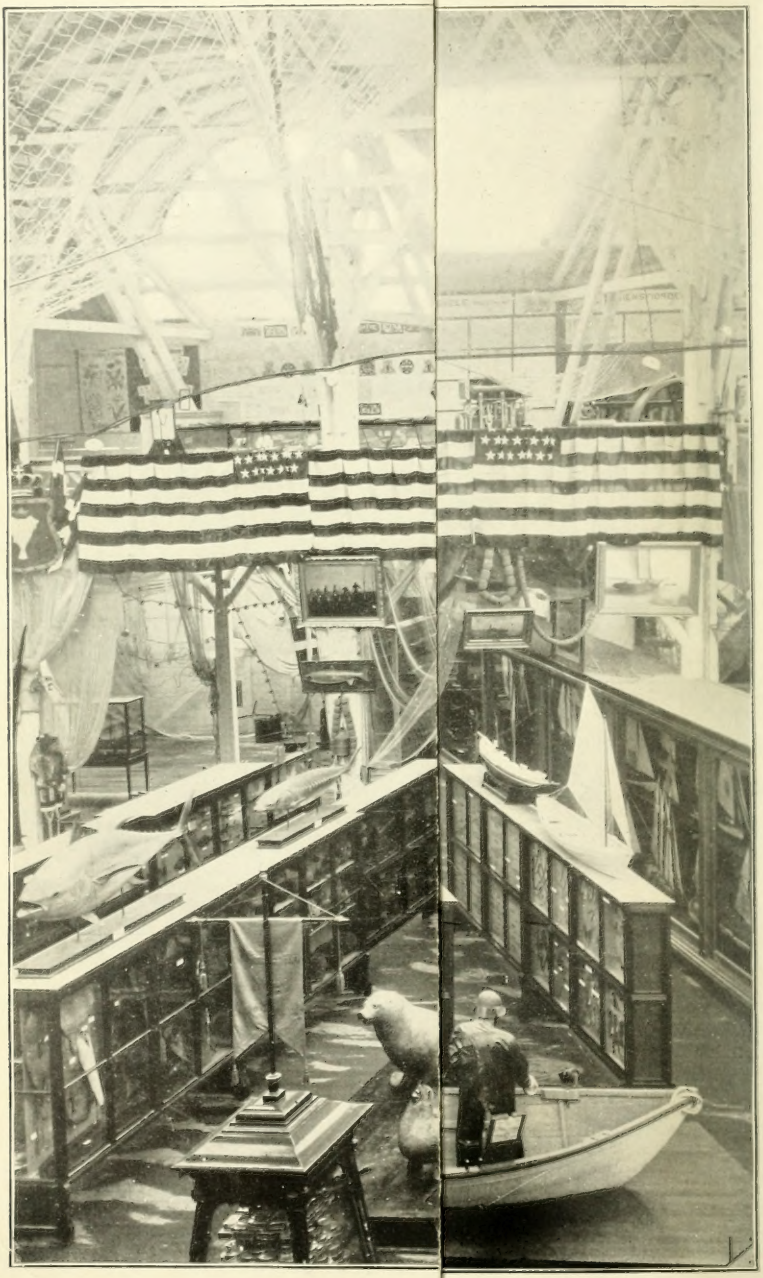

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UNITED STATES EXHIBIT, IN MAIN BUILDING.

Photographed by Nyblin.

To the Senate and House of Representatives:

I transmit herewith a communication from the Secretary of State, forwarding the report of the United States commissioner to the International Fisheries Exhibition of 1898 at Bergen, Norway.

WILLIAM MCKINLEY.

EXECUTIVE MANSION,
Washington, December 10, 1900.

The PRESIDENT:

I have the honor to submit for transmission to Congress the report of the United States commissioner to the International Fisheries Exhibition of 1898 at Bergen, Norway.

Respectfully submitted.

JOHN HAY.

DEPARTMENT OF STATE,
Washington, December 6, 1900.

DEPARTMENT OF STATE,

Washington, March 2, 1898.

SIR: The President having, under the joint resolution of Congress approved February 17, 1898, appointed you to represent the United States at the International Fisheries Exposition to be held at Bergen, Norway, from May 16 to September 30, 1898, I inclose herewith your commission in that capacity.

I also inclose a copy of the joint resolution. Its object is to secure at the exposition a suitable and proper exhibition and display of the food fishes of the United States and the methods of catching, salting, curing, and preserving the same, and of the implements and appliances used in carrying on the fishery industries of the United States. To this end you may, with the consent of the Secretary of the Smithsonian Institution, use at the said exposition any portion of the fisheries collection in the National Museum.

To pay the expenses and costs of representing the United States at the exposition and to pay all the costs and expenses and outlays pertaining or incident to the making and carrying on of the exhibition and display aforesaid, the sum of $20,000, or so much thereof as may be necessary, has been appropriated by Congress. Of this appropriation the sum of $2,500 is specifically set aside by the joint resolution for your compensation, including your personal and traveling expenses.

The disbursing clerk of the Department of State will pay any accounts for expenses that you may actually and necessarily incur in carrying out the intention of Congress in the United States. Previous to your departure for Bergen you will be furnished with a letter of credit upon the Government's bankers in London, upon whom you will subsequently draw. You will promptly furnish the Department with an account of your expenditures under the letter of credit, supported by subvouchers.

At the end of the exposition you will, in accordance with the direction of the joint resolution, make a full report to the Department of State of the participation of the United States therein, and of all the information and results acquired and obtained at or by means of said exposition touching the fishing industry throughout the world.

Respectfully, yours,

JOHN SHERMAN.

J. W. COLLINS, Esq.

(Care Commissioner of Fish and Fisheries, Washington, D. C.).

Mr. Collins to the Secretary of State.

LAUREL, MD., *May 20, 1899.*

SIR: I have the honor to forward herewith my official report as United States commissioner to the International Fisheries Exhibition at Bergen, Norway, in 1898. This report is divided into two parts.

Part I is a report upon the participation of the United States in the International Fisheries Exhibition at Bergen. This deals exclusively with the exhibit made by the United States, its preparation, installation, conduct, and return. It also embraces such other information as bears on the subject under consideration, including a synoptical catalogue.

Part II is a report upon the Bergen Exhibition and the fisheries collections exhibited by various countries. An effort has been made to embody in this part the "information acquired touching the fishery industry throughout the world," even although the time available for the preparation of these data has been inadequate for such an undertaking, having in view the care that must be exercised to insure accuracy in technical descriptions.

I respectfully invite attention to the illustrative material submitted herewith, particularly that relating to fisheries exhibits of other countries, and venture to hope it may be utilized, for it will undoubtedly enhance the value of the report.

Respectfully, yours,

JOSEPH W. COLLINS.

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PART I.

REPORT UPON THE PARTICIPATION OF THE UNITED STATES IN THE INTERNATIONAL FISHERIES EXHIBITION, BERGEN, NORWAY, 1898.

REPORT

UPON THE

PARTICIPATION OF THE UNITED STATES IN THE INTERNATIONAL FISHERIES EXHIBITION, HELD AT BERGEN, NORWAY, IN 1898.

AUTHORIZATION OF EXHIBIT BY THE UNITED STATES.

The authorization for the participation of the United States in the International Fisheries Exhibition, held at the city of Bergen, Norway, in 1898, was contained in the following joint resolution of Congress, accepting the invitation of the Government of Norway, approved February 17, 1898:

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That said invitation is accepted, and that the Commissioner of Fish and Fisheries is hereby directed, in person, or by a deputy to be appointed by the President of the United States, and whose compensation if not in the public service shall not exceed two thousand five hundred dollars including personal and traveling expenses to represent the United States at said Exposition, and to cause a suitable and proper exhibition and display to be made at said Exposition of the food-fishes of the United States, and the methods of catching, salting, curing, and preserving the same, and of the implements and appliances used in carrying on the fishery industries of the United States, and to this end may, with the consent of the Secretary of the Smithsonian Institution, use any portion of the fisheries collection in the National Museum at said Exposition.

That the sum of twenty thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any money in the United States Treasury not otherwise appropriated, to be immediately available, and to be expended under the direction of the Secretary of State, to pay all the expenses and costs of representing the United States at said Exposition, as aforesaid, and to pay all the costs and expenses and outlays pertaining or incident to the making and carrying on of the exhibition and display aforesaid at said Exposition: *Provided*, That the total expenses and liabilities incurred under this resolution shall not exceed the sum of twenty thousand dollars.

That the said Commissioner, or his deputy, is hereby directed to make a full report to the Department of State of the participation of the United States in said Exposition, and of all the information and results acquired and obtained at or by means of said Exposition touching the fishery industry throughout the world.

Approved, February 17, 1898.

FUNDS AVAILABLE.

From the foregoing joint resolution of Congress, the money available for making an exhibit of fish and fisheries of the United States

(including fish culture and scientific investigation) was limited to $20,000. From this amount all expenses of personnel, transportation of exhibits, and preparation of exhibition material had to be met. The sum appropriated was similar in amount to that assigned for the participation of the United States in the International Fisheries Exhibition at Berlin in 1880. But a comparison of the favorable conditions under which the exhibit was made by the United States in 1880 and those which prevailed in connection with the exhibit at Bergen, indicates that a larger sum was actually required in the latter case to meet the demands of the occasion, having in view the fact that the amount appropriated in 1880 barely sufficed for the expenditures of the exhibit at that time.

Professor Baird, in alluding to the exhibit of the United States at Berlin, mentioned the fact that "with unexampled liberality the great railroads between Washington, New York, Philadelphia, and Baltimore * * * agreed to transport packages [the exhibit of the United States] to the point of shipment, and return them to Washington free of expense. The North German Lloyd Company was equally generous, carrying them from New York and Baltimore to Bremen and back, free of cost, so that the entire mass * * * cost nothing whatever for transportation between Washington and Bremen. * * * Reduced rates of transportation were given to the party [the commissioner to the exhibition and assistants] by the North German Lloyd on the vessels of which company they were taken to Bremen."

The saving to the appropriation for the exhibit at Berlin, by this generous action of the transportation companies, was approximately from $3,000 to $5,000. In considering the amount available for the exhibit at Bergen, this should be remembered when making a comparison, since in the latter case no courtesies of this character were extended, and full prices had to be paid for transportation of material and personnel. It was also necessary to hire temporary quarters for the preparation and packing of the exhibit. The difference in these particulars between 1880 and 1898 amounted approximately to one-fifth of the appropriation. This indicates the necessity which existed for the greatest economy in the expenditure of the funds available for the exhibit of the United States at Bergen.

APPOINTMENT OF THE COMMISSIONER.

In conformity with the joint resolution of Congress, and in compliance with the nomination of Hon. George M. Bowers, United States Commissioner of Fish and Fisheries, the President appointed me, on March 1, 1898, to represent the United States, in Bergen, Norway, and to assume responsible charge and direction of the preparation and installation of the exhibit to be made by the United States.

SECTION OF UNITED STATES EXHIBIT, NEAR NORTH ENTRANCE TO MAIN BUILDING. MODEL OF MERRIMAC AT THE LEFT.

Photographed by Nyblin.

PERSONNEL.

As soon as possible after my appointment, the appointment and designation to duty of the individuals constituting the personnel received attention. Mr. George H. H. Moore, who for many years had been associated with the work of the United States Fish Commission, was selected as chief assistant in the preparation of the exhibits. Mr. W. H. Abbott, who had long been connected with the exposition work of the Fish Commission, was appointed in charge of the preparation of fisheries exhibits, and later was assigned to the important work of assisting in installation. Mr. Friman Kahrs, of New York, was appointed assistant, and sent to Bergen to look after the construction of a large case, screens, tables, etc., that were required for the installation of the exhibit, and which could be built in Norway for less expense than they could be transported from the United States to Bergen. Mr. W. H. Wentz was temporarily put in charge of accounts, but was subsequently assigned to other duties. Mr. W. H. Johnson was appointed as skilled laborer in the preparation of material. Mr. William P. Sauerhoff was temporarily assigned by the Commissioner of Fish and Fisheries to assist in packing the exhibit The appointment of most of the people referred to was made immediately after the appointment of the commissioner, and the assignment of Mr. Sauerhoff was made from time to time when absence from his usual duties was possible. Miss H. B. Blackwell was temporarily appointed as typewriter to assist in the office work during the period of preparation. Mrs. S. A. Collins was appointed secretary, in charge of accounts and correspondence, on April 15. On May 9 Mrs. G. C. Ennersen was appointed as translator and general office assistant. In addition a corps of laborers was employed in the preparation of the exhibit. The assistance received from collaborators will be referred to elsewhere.

As has already been stated, Mr. Kahrs was sent to Bergen immediately after his appointment; and on April 20 I sailed from New York, accompanied by the following members of my staff: Mr. W. H. Abbott, Mrs. S. A. Collins, Messrs. W. H. Wentz and W. H. Johnson. Mr. Moore remained in Washington to superintend the completion of the packing and shipment of exhibits, also to attend to other matters in connection therewith. Miss Blackwell was assigned to assist him until May 31.

APPLICATION FOR SPACE.

Hon. A. Grip, the minister from Sweden and Norway, very courteously offered to cable the executive committee of the exhibition, at Bergen, a request for space for the United States; subsequently he also cabled for plans of the area assigned.

The authorization for the participation of the United States in the exhibition had come so late that the executive committee were not prepared to assign the amount of space required, since they had only 6,000 feet available in the buildings, for the installation of the exhibit from this country, although they offered the United States the privilege of constructing, at its own expense, an additional building, or buildings, in the park, but the limitations of the appropriation made this impracticable, and it was decided to arrange the exhibit to fit the space allotted.

Beyond the knowledge of the amount of floor area available, received by cable March 1, nothing was known of the space to be occupied until March 17, when diagrams were received showing that the space at our disposal was in two buildings, but these gave no details in regard to the construction of the main building or other data requisite for the arrangement of plans for the exhibit. As there was no time to obtain additional information by correspondence, it was, therefore, necessary to go ahead with the preparation of the exhibit with only a meager knowledge of the character of the space to be filled, and the fact that the exhibit fitted so completely to its allotment is a matter for much gratification.

PLAN AND SCOPE OF THE UNITED STATES EXHIBIT.

The plan and scope of the exhibit of the United States were necessarily limited by the means, time, and space available for preparation and installation. In general, it was decided to embrace in the exhibit various animals, or other objects which constitute objects of fishery, or are included among those inhabitants of the waters that are useful or injurious to man; specimens of apparatus—including boats and vessels—by which they are pursued, taken, or otherwise obtained; illustrations of the methods of capture; representations of the methods and machinery for utilization; samples of raw material, and collections of manufactured products derived from fisheries; representations, by models or otherwise, of appliances and methods for the artificial production and multiplication of economic species; and illustrations of scientific research relating to fisheries and fish culture.

PREPARATION OF COLLECTIONS, ETC.

The scope and magnitude of the exhibit were promptly decided upon as soon as limitations of space to be occupied were known. The special character of some details was influenced by the fact that the United States Fish Commission had to make an exhibit at Omaha, Nebr., contemporaneous with that made at Bergen. Therefore, as the material intended for exhibition at Omaha had already been selected, and most of it prepared before I was appointed, the available collections of the Commission were reduced to that extent. For this

reason it was not so easy, as it otherwise might have been, to obtain all that was required for a symmetrical presentation of objects relating to fish and fisheries of the United States. This difficulty was, however, overcome much more readily than might have been expected, although the accomplishment of this task involved much additional labor. Owing to the conditions alluded to it became necessary to supplement the available material, to some extent, and especially in certain directions, in order that the objects of fishery and fishing products should be properly represented.

The time at command for the assembling, preparation, packing, and shipment of collections was so exceedingly short that the accomplishment of the work, within the limit, seemed almost beyond possibility. This will be evident when consideration is given to the fact that the date of my appointment was only two and a half months prior to the opening of the exhibition; and, inasmuch as no line of steam vessels was running direct from United States ports to Bergen, the transshipment of material in Europe had to be counted upon. Fully one month of this time, or more, was required for transportation of collections after they were shipped.

The work of preparation was inaugurated on the very day of my appointment. A suitable building for the preparation and packing of the collections was rented. Among the first work done was the repairing and putting in proper order for exhibition of a series of models of fishing boats and vessels obtained from the collections in the United States National Museum. At the same time lists of other material in the Museum, or held in storage, were made out, and Mr. Abbott was detailed to look after its obtainment.

Correspondence was also opened with preparators, manufacturers of fishing tackle and fishery products, State authorities, and others who were known to have material that was desirable, and which they might be disposed to exhibit. It was apparent, however, that time was too short to conduct an extensive correspondence, especially with people resident on the other side of the continent. Nevertheless, it is gratifying to observe that much more was accomplished than could have been anticipated, and with the exception of fish products, and a few other objects, all was obtained that might reasonably have been expected, and fully as much as there was room to accommodate. The following is a sample of a letter widely circulated:

UNITED STATES COMMISSION OF FISH AND FISHERIES,
INTERNATIONAL FISHERIES EXPOSITION, BERGEN, NORWAY,
Washington, D. C., March —, 1898.

An exhibit of the fish and fisheries of the United States will be made at Bergen, Norway, the present year, by the United States Fish Commission, under the authority of the joint resolution of Congress, approved February 17, 1898.

The Bergen Exposition opens May 15 and will close September 30.

The resolution provides that "a suitable and proper exhibition and display [shall] be made at said [Bergen] Exposition of the food-fishes of the United States, and the

methods of catching, salting, curing, and preserving the same, and of the implements and appliances used in carrying on the fishing industries of the United States."

For this purpose the sum of $20,000 has been appropriated, and information has been obtained that the space available for the installation of the United States exhibit will not exceed 6,000 square feet of floor space.

While these limitations, as well as the extreme shortness of time available for the preparation and shipment of material, make it difficult if not impossible to provide for American exhibitors the space, etc., that may be justly considered desirable, the fact remains, nevertheless, that this opportunity to display in Europe the products and manufactures relating to the fisheries of this country should not be neglected.

The advantages to be gained by American exhibitors at a technical exposition like that to be held at Bergen have been so fully demonstrated heretofore that discussion is unnecessary.

Nor has this depended on the size of individual displays, but rather on excellence of the material.

The object, therefore, of the commission is to offer to possible exhibitors every facility consistent with the limitations indicated, and it is confidently expected that manufacturers and producers will be disposed to participate in this exposition, bearing in mind that quality rather than quantity will be considered in making awards.

The commission will undertake the installation, care, and transportation of any material loaned to it for exhibition purposes, and will return the same at the close of the exhibition.

I wish to learn at the earliest practicable date if you desire or intend to exhibit material at Bergen; also the space you estimate will be required, and the earliest date when you can send the objects here or to the point of shipment.

Please use the inclosed envelope, upon which no postage will be required.

Yours, very truly,

J. W. Collins, *Commissioner.*

The time available for preparation of exhibits was so inadequate that many who might otherwise have desired to exhibit were disinclined, for the reason that they felt they could not arrange a display that would be satisfactory. In many cases it was impossible for packers of fishery products to prepare an exhibit on so short a notice, particularly as the notification reached them "between seasons," when they had disposed of their previous year's pack, and before it was possible for them to utilize the season's catch.

The necessity, too, of limiting exhibits to the minimum of space prevented some from exhibiting, who believed that a small collection would receive little attention.

After the work was well organized and in an advanced stage of completion, I found it necessary to make a brief trip to New York and New England to confer with parties who possibly might desire to exhibit, particularly fish packers. In most instances the packers were disinclined to make exhibits, and I had to purchase the material needed for a reasonable presentation of fishery products.

In the meantime correspondence had been begun with various railroad and steamer companies in order to secure the best terms for the transportation of the exhibits to Bergen. Arrangements were made

SECTIONAL FRONT VIEW OF UNITED STATES EXHIBIT.

Photographed by Nyblin.

with the Pennsylvania Railroad to carry the material from Washington to New York, and with the Wilson Line to transport the exhibits from New York to Bergen, transshipping the collections at Hull, England. This was the most direct route available, and was much cheaper than any other. Material sent from other points than Washington reached New York over various lines of railroads, but all went via Wilson Line to Bergen.

The first shipment from Washington, amounting to about 53 tons measurement—two carloads—left April 4; the second shipment was made on April 11. These two shipments constituted a large part of the collections.

The work of preparation was pushed with the utmost vigor, and by the last of April the bulk of the material had been shipped and the remainder was in an advanced stage of preparation. The last shipment was made on May 9.

In the last few days prior to my departure for Europe I prepared a preliminary catalogue of the exhibit. Previously it had been necessary to prepare and print many labels, both in the English and Norwegian languages.

INSTALLATION AND CONDUCT OF EXHIBIT.

PRELIMINARY PREPARATION FOR INSTALLATION, ETC.

I reached Bergen on April 30, accompanied by the persons heretofore referred to. At that time none of the collections had arrived. The large case for models of fishing vessels and boats was well advanced in construction, so far as the woodwork was concerned, but certain iron accessories obtained in New York had not been received. These came in a few days; but the glass for the case, which should have been delivered in the early part of May, did not reach Bergen (from Belgium) until about two months later.

Nothing had been done toward having the screens and tables constructed. No time was lost, however, after my arrival, and the preparatory work was pushed with all possible expedition in the main building, but, owing to changes referred to elsewhere, nothing could be done to advance installation in the annex. The work in the annex was promptly inaugurated, but was soon discontinued, and nothing could be done in this direction for several weeks because of delay in completing a new structure, where ultimately the fish-cultural collections, fishery products, etc., were installed.

MODIFICATION OF ALLOTMENT OF SPACE.

Subsequent to the allotment of space, some modifications were made in it. In the main building, a portion of the exhibit of Denmark, the installation of which was completed before I reached Bergen, was

allowed to encroach upon a corner of the space given to the United States, but this, fortunately, did not seriously interfere with the plans made for our display. The exhibition authorities also found it necessary to assign to the Norwegian fisheries material the space in the annex building which had originally been allotted to the United States, and the part of our exhibit intended to be placed there was provided for in another structure, erected mainly for that purpose. The space so allotted was a little larger than that first assigned, and therefore better suited to the requirements of our collections.

OFFICES, ETC.

It was found absolutely impracticable to set aside any space in the exhibition buildings for the purpose of an office, since every available

FIG. 1.—United States whaling and sealing exhibit. (Photographed by Nyblin.)

foot was required for installing the collections. Fortunately, a suitable room for office requirements, located outside the grounds, but, nevertheless, only a short distance from the main building, was obtainable at a moderate rent, and this was secured. Previous to this, however, my apartments had to be used as an office, and at all times I did much work there.

ARRANGEMENT OF EXHIBITS.

The division of the exhibit, whereby part of it was installed in the main building and part in an annex some distance from the principal

structure, made impossible a unified and harmonious arrangement of the collections. This difficulty was enhanced by the limitations of space, which necessitated crowding, and by other conditions which did not admit of such exact classification of material as otherwise might have been possible. In the main, however, it was practicable to secure a fairly satisfactory installation, considered even from this point of view —better in fact than is usual at exhibitions —while looked at from the standpoint of effective arrangement, so far as the conditions admitted, there was little to be desired. Reference is made to the accompanying plans and illustrations for a better understanding of the installation.

The general plan was to install the collections relating to fish and fisheries, including scientific research, statistics, etc., in the main building. Aquatic animals or plants of North America, beneficial or injurious to man generally constituting objects of fishery were placed at the northwest end of the section. These included mammals, such as seals and sea lions, fish-eating birds, reptiles and batrachians, fishes, mollusks, crustaceans, echinoderms, sponges, crayfish, etc. Associated with these were charts and maps of fishing grounds, literature and statistics of fish and fisheries, photographs and drawings illustrative of scientific investigation, and various other things, such as nets and other forms of apparatus, thus placed for decorative effect or exhibition purposes.

The large photographs, drawings, and paintings, illustrating methods of fishing, the curing or packing of fishery products, the economic condition of the fishermen, fishing towns, etc., occupied the central portion of the space on the side next the wall, being hung for the most part on the wall and on screens erected for the purpose. Some paintings of this character were hung in front, just beneath the gallery, where they could be seen to the best advantage.

The smaller photographs pertaining to the same subjects were, of necessity, placed elsewhere, chiefly next the main aisle at the end of the big case, while the large group of full-size dory and figures of fishermen, illustrating trawl-line fishing, was on the main isle, immediately in front of the cases containing hooks and lines.

The apparatus of fishery, including angling appliances, was, to a large extent, installed in the southeast portion of the section. In order, however, to produce satisfactory effects in the installation and at the same time utilize all of the space to the best advantage, various forms of apparatus, more particularly nets, traps, and pots, were suspended from beneath the gallery, draped upon the posts, fastened to the walls and screens in suitable positions, and otherwise used in a decorative way.

Models of fishing vessels and fishing boats filled the 50-foot case located at the extreme end of the United States section, next the space occupied by the Japanese exhibit. A few of the models, however, for

which there was not space in the case, were placed on top of other cases, and a number of builders' models were displayed on the wall at the end of the large case. Supplementing all these were a number of large photographs of fishing schooners, in process of construction or under sail; these were hung next to the builders' models referred to. A few small photographs were on the wall with the models, but the illustrations of fishing vessels were chiefly on swinging screens, at the opposite end of the case, together with similar material relating to other phases of fishery. Full-size kaiaks and a bidarka were placed along the extreme upper part of the wall, which was the only space available for them, and where they could be seen very well, while this arrangement added to the effectiveness of the general installation of the collections in the main building. No space could be found in this section for a folding canvas boat, consequently it was placed elsewhere.

The front of the gallery, which was directly over the center of the United States section in the main building, had an unfinished appearance, and to insure a satisfactory effect it was necessary to treat this somewhat in a decorative way, and at the same time to give it a distinctively national character. In the center, above the section, was placed a large sign, containing the words "United States." Above this was the shield of the United States and a group of flags, while American ensigns were draped along the front of the gallery over the entire space occupied by our exhibit. At the extreme end next to the Danish section, and at right angles to the gallery, was suspended, underneath the latter, a sign containing the following words: "United States Commission of Fish and Fisheries." This sign served to indicate the exhibit of the United States to people entering the building at that end, who might temporarily be in a position so that the national designation in front was not discernible.

The collections illustrative of fish culture, including the transportation of fish, fry and eggs, were installed in the annex, which adjoined the building where the Norwegian fisheries exhibits were located. The fishery products — with the exception of pearls, leather made from skins of fishes, water snakes, alligators, etc., and the objects manufactured therefrom — were also exhibited there. The former occupied the walls, for the most part, and the main portion of the floor space next the entrance to the building. The products filled the remaining floor space, in cases and on tables, and some illustrations connected with them were hung on the wall on the same side of the section.

Models of fish hatcheries; a model of the Fish Commission schooner *Grampus;* model of a car for transporting fish and eggs; a series of hatching and transporting apparatus; equipments for spawn takers or messengers; and various other objects, mounted on stands or displayed on tables, occupied the floor space assigned to fish culture, where also was a series of photographs in swinging screens.

On the walls were statistical maps containing summations of the fish

cultural work of the United States Fish Commission; a large map of the United States, upon which was indicated the location of the various stations of the commission; large photographs of the commission's steamships *Albatross* and *Fish Hawk*, and a series of large photographs of fish-hatching stations, ponds for rearing fish, and cars for carrying fry and eggs.

On the side next the door was placed a full-size collapsible canvas boat, and also the trunk in which it could be packed for transportation.

Perhaps the most noticeable thing in the fish cultural exhibit, considered from the standpoint of its appreciation by visitors to the exhibition, was the group of life-size figures of men mounted in a boat, so arranged as to graphically illustrate the capture of the shad and the obtainment of the eggs of that species for the purpose of artificial propagation. This stood on the main aisle which separated the section of the United States from that occupied by some English exhibits.

The bulk of the fishery products were arranged —usually in a pyramidal form—on tables placed against the walls. A portion of such material was, however, installed in cases, and in one instance a stuffed specimen of a sturgeon was suspended over a case in which were collections of products from this fish, including caviare put up in different kinds of packages.

Netting was draped in all parts of this section, so as to produce a pleasing and characteristic effect, and, so far as possible, to soften the unfinished appearance of the interior of the structure.

A sign, with the words "United States Commission of Fish and Fisheries," was placed across the wall at the end of the building, and above this were grouped American flags—an arrangement which suggested the nationality of the exhibit and secured a satisfactory effect.

WORK OF INSTALLATION.

The work of installation was begun at the earliest practicable moment and pushed with the utmost energy both night and day. Although no artificial light was permitted inside the buildings, daylight was generally sufficient until 10.30 or 11 p. m., and the effort to get the collections in place did not cease at night while it was practicable to see well enough for labor to be continued. It was generally between 11 o'clock and midnight before the day's work ceased.

Some difficulty was experienced in getting the material carted across the city to the exhibition, because of the occurrence of a succession of events which temporarily suspended work of all kinds. A large consignment of exhibits reached Bergen shortly before the opening day, but it was impossible to get the material moved. The day succeeding that upon which the opening ceremonies were held was the national holiday—the 17th of May. It corresponds, in public

estimation, with the American Fourth of July, and is celebrated in Norway, especially in Bergen, with the greatest patriotic ardor. Two days later, on May 19, a church festival occurred, during which no teaming could be done. Thus a whole week passed while our goods were lying on the quay, the movement of them being a practical impossibility. This will show the character of certain unsurmountable obstacles that delayed completion of installation despite all that could be done.

Considerable delay was also caused by the extraordinary amount of breakage and the consequent necessary repairs, which had to be made under adverse circumstances. Upon unpacking the collections it was found that a large quantity of glass was broken, and serious damage was done in other directions. This was surprising and unexpected, since the material had been packed in the most careful manner by experts of the United States Fish Commission, who had performed similar service for many years, and always with marked success. Inasmuch as the same kind of exhibits—indeed, much of the same material—had repeatedly been transported over the railroads of this country without material injury, the abnormal breakage seemed to indicate careless handling on shipboard in loading and discharging, and a total disregard of printed directions on the boxes. I learned of no conditions that would be a sufficient excuse for thus jeopardizing the interest of a shipper, whoever was responsible for the damage done.

Mr. Abbott was the only assistant who had had any experience whatever in installation work. He ably seconded my efforts, and at all times was efficient, resourceful, and indefatigable in his efforts to secure satisfactory results.

The haste with which the collections had been assembled and the fact that some of them were not received until I was about to leave Washington made it impracticable to prepare and print all the required labels. It is true that many English labels were printed before I left the United States, but it was then impossible to prepare labels in the Norwegian language for objects other than models of boats and vessels. The translation of labels into Norwegian for other exhibits, a most onerous task, fell on Mrs. Emmersen during the installation period, while the secretary, in addition to other duties, was called upon to write hundreds of descriptive labels in English. It was a busy time, when those who had the welfare of the exhibit at heart were taxed to the utmost, but the result attained was to them ample recompense for the unusual effort required.

Complete success in installation was materially aided by the generous assistance of two public-spirited gentlemen of Bergen. One of these was Mr. Peter Jessen, of the Fagerheims Notfabrik, one of the largest net manufactories in Norway, who not only generously supplied without charge all the netting required for decorative purposes,

but sent his own men to hang it, and also came himself to confer with me concerning its proper arrangement, so that he might be sure his men acted in conformity with my desires. At the close of the exhibition he likewise furnished his own men to remove the netting.

After the gallant deed of Lieutenant Hobson and his associates had made famous the transport they sunk at the entrance to Santiago Harbor, and the name of the *Merrimac* was on every tongue, Hon. Chris. Michelsen, president of the exhibition, volunteered to lend me the model of that vessel for installation in the United States section, a courtesy that was promptly accepted. Subsequently he offered to present the model to the United States, and it was accepted on behalf of the United States National Museum, where it has been placed.

It may be explained in passing that this vessel, now so celebrated in the annals of our naval history, was built for Mr. Michelsen at Newcastle on Tyne in 1894. She was originally named the *Solveig*. In 1897, while at Newport News, she caught on fire, was completely gutted, and sunk. Subsequently she became the property of American owners, and ultimately was obtained by the United States Government for use as a transport in the Spanish-American war of 1898, in which capacity she was serving when she was utilized in the attempt to "bottle up" Admiral Cervera's fleet in Santiago.

JUDGING THE EXHIBITS.

The jury work began July 4, when the so-called "jury groups" were organized. There were thirteen of these, of which nine were charged with making awards to the national industrial exhibits, and four (jury groups 10 to 13, inclusive) were international in their composition, and had the duty of passing upon the merits of exhibits in the International Fisheries Exhibition. The exception to this was that jury group 9, which dealt with sports, including angling, was authorized to pass upon the merits of international collections relating to sport fishing. While apparently looked upon as somewhat removed from the status of the other international juries, it was really like them, or at least closely allied to them, not only in function, but to some extent in personnel. The United States was represented on this jury.

The work of the international juries was passed upon and revised by a so-called over jury, which was composed of the chairman of the executive committee of the exhibition, Mr. Chr. Lehmkuhl, ex officio chairman of the jury, and the presidents and vice-presidents of the several juries that dealt with international exhibits. This was a very commendable arrangement, for the revisionary work was most important. As a result the awards were made more deliberately and with a better understanding of their merits than otherwise would have been possible.

We were deficient in men sufficiently experienced to serve on juries,

consequently were at a disadvantage, inasmuch as it was difficult and often impossible, for the same individual to give full attention to the work on more than one jury group. Every effort was made to accomplish this, so far, at least, as American exhibits were concerned, and the result indicates that the interests of exhibitors were most carefully guarded.

Mr. Abbott was designated to serve on jury groups 11 and 13; Mr. Kahrs on jury groups 9 and 10, while I served on jury 12, which seemed one of the most important, and also on the over jury.

The work was very taxing, especially that on the over jury; the necessity for early completion of the task compelled long hours of exhaustive labor, but the knowledge thereby gained of the material exhibited amply repaid the writer for extraordinary effort. The labors in connection with judging the international exhibits were brought to a close about the middle of August.

AWARDS.

The following is a list of awards granted exhibitors in the sections of the United States:

A.—Diplomas of Honor.

1. United States Commission of Fish and Fisheries, collective exhibit in twenty-three classes of the various groups in which it participated.
2. Hydrographic Office, Bureau of Navigation, United States Navy Department, for collection of charts.
3. Coast and Geodetic Survey, United States Treasury Department, for collection of charts.
4. Thomas F. McManus, Boston, Mass., models and photographs of fishing vessels.
5. Tiffany & Co., New York, N. Y., for exhibit of fish and alligator skins, pearls, etc.

B.—Gold Medals.

6. Max Ams, New York, N. Y., one medal for smoked eels and sturgeon, and one for new method of hermetically closing tin cans.
7. Sherman F. Denton, Wellesley, Mass., for work on fish casts and mounted fish skins.
8. Henry W. Elliott, Cleveland, Ohio, for drawings and water-color paintings of Alaska, including series illustrating life habits, etc., of the fur seal.
9. The Horton Manufacturing Company, Bristol, Conn., for steel fishing rods of various kinds.
10. The William J. Hooper Manufacturing Company, Baltimore, Md., for collection of fishing nets, traps, etc.
11. H. & G. W. Lord, Boston, Mass., for collection of twine, nets, and seines.
12. L. D. Lothrop, Gloucester, Mass., for collection of fishery apparatus.
13. B. C. Milam & Son, Frankfort, Ky., for collection of fishing reels.
14. William F. Nye, New Bedford, Mass., for excellent quality of chronometer oils.
15. Eben Pierce, New Bedford, Mass., for collection of whaling apparatus.
16. Joseph Rowe & Co., Gloucester, Mass., for collection of oil clothing.
17. William H. Wonson, Gloucester, Mass., for smoked halibut.
18. Russia Cement Company, Gloucester, Mass., for fish glue and fertilizers.
19. Hugh M. Smith, Washington, D. C., for exhibit showing artificial cultivation of sponges.

SECTION OF UNITED STATES EXHIBIT IN MAIN BUILDING.

Photographed by Nyblin.

C.—Silver Medals.

20. J. W. Beardsley's Sons, New York, N. Y., for smoked boneless herring and shredded codfish.
21. Bristow & Dixon, Stormont, Va., for deep-water oyster tongs.
22. Paul E. Collins, Boston, Mass., for paintings illustrating different methods of catching fish.
23. Mary A. Gardner, Miami, Fla., for artistically made fish-scale jewelry.
24. Charles B. Hudson, Washington, D. C., for drawings of fishing vessels and boats.
25. George Marshall, Laurel, Md., for collection of fish-eating birds.
26. John R. Neal & Co., Boston, Mass., for finnan haddies.
27. Chresten Nelson, Gloucester, Mass., for canvas and net preservative.
28. William Palmer, Washington, D. C., for casts of fishes.
29. G. M. Skinner, Clayton, N. Y., for spoon baits.
30. J. & W. R. Wing, New Bedford, Mass., for whalebone.

D.—Bronze Medals.

31. A. H. Baldwin, Washington, D. C., for drawings of economic batrachians.
32. The Enterprise Manufacturing Company, Philadelphia, Pa., for bait and meat chopper.
33. Charles B. Hudson, Washington, D. C., for painting illustrating method of fishing.
34. Edward Pitcher, Brooklyn, N. Y., for collection of hooks, drails, etc.
35. A. Zeno Shindler, Washington, D. C., for water-color painting of the Great Auk, and oil paintings of Funk Island.
36. Charles H. Townsend, Washington, D. C., for collection of photographs of fur seals, etc.
37. J. & W. R. Wing, New Bedford, Mass., for collection of whaling apparatus.

E.—Honorable Mention.

38. G. B. Borden, Acushnet, Mass., for net made of whalebone.

F.—Diplomas of Thanks.

39. Marcus Benjamin, Washington, D. C., for collection of portraits and autographic letters of presidents of the American Association for the Advancement of Science.
40. W. H. Benton, Washington, D. C., for preparation of statistical charts.
41. Paul E. Collins, Boston, Mass., for drawings.
42. F. F. Dimick, Boston, Mass., for collection of reports of the Boston fish bureau.
43. Barton Warren Evermann, Washington, D. C., for collection of fish literature.
44. George E. Jennings, New York, N. Y., for bound volumes of the Fishing Gazette.
45. David Starr Jordan, Leland Stanford Jr. University, Stanford University, Cal., for collection of fish literature.
46. George Frederic Kunz, New York, N. Y., for literature on pearls.
47. George H. H. Moore, Washington, D. C., for fossil fish.
48. Memorial Museum, Golden Gate Park, San Francisco, Cal., for collection of Pacific coast fishes.
49. W. de C. Ravenel, Washington, D. C., for fish-cultural literature.
50. A. F. Rich, Boston, Mass., for photograph of fishing steamer.
51. Scientific Publishing Company, New York, N. Y., for literature on pearls, etc.
52. Thomas W. Smillie, Washington, D. C., for photographic work.
53. Leonhard Stejneger, Washington, D. C., for literature on fur seals.
54. S. G. Worth, Washington, D. C., for photographic work.

It is pertinent to explain that the several juries unhesitatingly awarded a diploma of honor—the highest award given by the exhibition—to the collective exhibits of the United States Commission of Fish and Fisheries in each of the twenty-three classes of the various groups, in which it participated. The single diploma of honor actually given the Commission embodies in itself all of the awards made for these several collective exhibits.

Having in mind the haste with which the material was assembled for the United States exhibit at Bergen, the restrictive limitations necessarily placed on private exhibitors, and the fact that Mr. Abbott's exhibit did not compete, the result attained in the procurement of awards appears to be most gratifying.

The total number of competing exhibitors other than the United States Commission of Fish and Fisheries numbered fifty-five. The total number of awards made to these aggregate fifty-three. Some exhibitors received two awards, it is true, but the total number granted amounted to more than 96 per cent of the entire list of competing exhibits, a result never previously attained or even approximated by the United States at any international fisheries exhibition, and probably not elsewhere. This may undoubtedly be taken as an indication of the advanced position occupied by the United States in certain directions and the intelligent appreciation of that fact by those who were called upon to officially pass upon the merits of the exhibits.

DECREASE OF PERSONNEL.

The limitations of the appropriation compelled a decrease in expenditures for salaries; consequently a reduction of the personnel was necessary at the earliest date practicable. Of course laborers employed in connection with the installation were discharged as soon as their services could be dispensed with. The services of Mr. Kahrs ceased on September 30, the date fixed for the close of the exhibition; those of Mrs. Ennersen October 15, and those of Mr. Wentz on October 31. Thus the force was reduced one-half as soon as practicable after the close of the exhibition. It was necessary to keep the remaining assistants on the rolls until the collections were returned to the several persons from whom they were obtained and the business of the exhibit was completed.

APPLICATION FOR PUBLICATIONS, ETC.

The applications for publications of the United States Commission of Fish and Fisheries were numerous and urgent. These came not only from Norwegian museums, fishery schools, etc., but also from gentlemen prominently identified with the fishery, fish-cultural, and scientific interests of other countries.

In many, if not in all, cases the societies or other organizations or persons applying had received the publications of the commission in former years, but for some reason they had failed to get them for several years past—anywhere from three to six years although in some instances the European exchanges had constantly been sent to the commission.

In every case when the facts were brought to my notice I promptly notified Commissioner Bowers, who, I am pleased to say, most cordially responded, thus taking an action that restored the appreciation in which the commission was formerly held in Europe.

Applications were also received from various museums and societies for other material. These were complied with so far as practicable.

CLOSE OF EXHIBITION, ETC.

CHANGE IN DATE OF CLOSING.

The original programme for the exhibition contemplated bringing it to a close on September 30. As that date drew near, however, it was decided to continue it until October 2, which became the official date for closing.

DISPOSITION OF THE COLLECTIONS.

The material constituting the exhibit of the United States, and embracing both public and private collections, was, with some exceptions, returned to Washington as soon as practicable after the close of the exhibition. From this point the bulk of the private exhibits were sent to their respective owners, while the collections belonging to the Government were restored to the various places in the National Museum, Fish Commission, or storage, from whence they were obtained. By direction of the Secretary of State the unexpended material purchased for the exhibit was placed in the custody of the Fish Commission.

The cases, however, which had been procured from the Fish Commission at Woods Hole were shipped directly to that point from Bergen. The collection of fish casts exhibited by the Memorial Park Museum of San Francisco was not included in the material shipped to Washington, but, in compliance with instructions from the Park Museum authorities, was sent to Wellesley, Mass., to be repaired. Some of the private exhibits were sold in Europe, in whole or in part, by request of exhibitors, and in a few cases I presented to Europeans certain objects from private collections, in accordance with instructions from the owners, the special purpose of such donations being to invite attention to American manufactures. The most noticeable action of this kind was taken by the Horton Manufacturing Company, of Bristol, Conn., who requested me to dispose of as much of their exhibit of

steel fishing rods as I thought best. Mr. Max Ams, of New York, also authorized me to present to various museums and schools fish products, stuffed fishes, and tins showing his new method for hermetically closing cans without solder.

The Scientific Publishing Company and Mr. George F. Kunz both authorized the presentation of their publications on pearls and gems to the Bergen Fisheries Museum. The W. J. Hooper Manufacturing Company, of Baltimore, Md., presented their collection of models of fixed and floating nets to the Trondhjem Museum, and many others contributed to schools and museums.

There is every reason to believe such intelligent and generous action will have a most satisfactory result.

By direction of Hon. George M. Bowers, United States Commissioner of Fish and Fisheries, the collection of alcoholic specimens of salmonidæ; and all the 8 by 10 inch photographs of United States Fish Commission hatching stations, etc., were presented to Dr. Decio Vinciguerra, director of the royal fish cultural station at Rome, Italy.

Three boxes of material—two containing manuscripts and office equipments and one the awards made to American exhibitors were shipped to Washington early in October. The exhibits, however, were not dispatched until a month later; they left Bergen November 4 and arrived at New York on November 29. They reached Washington December 6, and the work of unpacking and distribution of the material was completed in the latter part of January.

In order to care for the collections in transit as much as practicable, Mr. W. H. Johnson was detailed to accompany the shipment on the Wilson Line steamships from Bergen to New York, and was instructed to secure a careful handling of the packages, so far as possible. His report indicates this action was well taken, and that much breakage and consequent expense to the Government was saved.

APPOINTMENT OF DEPUTY.

The recent remarkable development of the British deep-sea market fisheries—contrasting so strongly with the decadent condition of the New England ocean fisheries—convinced me of the importance of personally studying the methods and conditions prevailing at some of the chief fishing ports and markets on the east coast of Great Britain, even though I had to do this at my own expense. In order to accomplish this it was necessary to put some one in charge of packing and shipping the exhibit collections. Having, therefore, attended to the preliminaries associated with the packing, arranged the exchanges, etc., I left Bergen for Newcastle, England, on October 8, placing Mr. W. H. Abbott in charge of the work, and giving him detailed instructions for its conduct. This duty was most satisfactorily and expeditiously performed by Mr. Abbott, while the expense was 25

per cent less than the estimates, which were based on similar work at other exhibitions. Ordinarily fully six weeks are required to pack and ship such an exhibit as that of the United States, even when conditions are favorable. But on this occasion the material was all packed, carted about a mile and a half over a hilly road to the quay, and loaded on a steamer in one day over a month, notwithstanding the days were short and artificial light was not permitted in the exhibition buildings.

PRESS COMMENTS.

The exhibit of the United States attracted much favorable comment from press and people, and by unanimous consent it excelled all others in completeness, systematic arrangement, and effective method of installation. There seemed to be no difference of opinion, for the press of continental Europe, of Great Britain, and of the United States vied with each other in commendatory remarks concerning the exhibit that must prove most gratifying to our people, as well as to those charged with responsibilities in connection with it. It would be impractical, of course, to quote these to any considerable extent, but brief extracts may suffice to show the drift of public opinion.

The following is a free translation of a small portion of an article in the Bergen News (Bergens-Tidende) of May 23, 1898, under the head of "America's rich collection of fishing boats and vessels:"

The collection of models installed in the 50-foot case in the main building is both attractive and instructive. The case contains models of all kinds of fishing boats and vessels now used on the coasts of the United States, from the Eskimo's skin boat, the dugout from Alaska, or the Indian's birch-bark canoe to the modern clipper schooners from the New England States. There is also a special series of models, showing the development in the fishing schooner from the first settlement of America until to-day. This historical collection, as it ought to be called, deserves special attention. * * * One of the most interesting models is that of the fishing vessel *Sparrow Hawk*, since it is the earliest fishing smack used in America of which there is a model. It was a small vessel (about 40 feet long) which was wrecked on Cape Cod in 1626. It was buried in the sands more than two hundred years, until 1863, when wind and waves brought its remains to light. * * * The vessel was carefully dug up and sent to Boston, where it was exhibited in the park (Boston Common). * * * An American shipbuilder took careful measurements of all its parts, and the model was made from these.

There are other interesting models of vessels used two hundred years ago in the Atlantic Ocean fisheries, also a Marblehead vessel for fishing on the banks of Newfoundland in 1750. * * *

Among other types are found the ketch; Chebacco boat; pinky; the square-stern schooner from 1830 to 1850, and different forms of schooners built from 1874 up to the present. The latter ends the series, which shows more clearly than words the intelligent and tireless energy of the American in securing improvement whenever possible. * * *

The Norwegian shipbuilders and fishermen will surely derive both pleasure and instruction in studying this collection, because the models are carefully made to a scale in every detail.

Under the caption of the "United States of America at the fisheries exhibition at Bergen," the Göteborgs Handels- och Sjöfartstidning, one of the most influential of Swedish papers, makes the following remarks:

The country of the star-spangled banner partakes in a manner which honors the same. A more instructive exhibition than this one is hard to find.

It shows in different series the development of the various kinds of fisheries presented in an excellent and clear manner.

Further, there are shown fishhooks such as are used by the Indians and Eskimos, made of wood and bone, and often carved with figures. The hooks are made of nails, found in driftwood or obtained by exchange from the Europeans. The halibut hooks are of special interest. They are large and clumsy and look impossible to use for a good fishery, but the natives keep them and prefer them to the modern ones.

A collection of models of fishing vessels is found, even from the large whaling steamer to the Eskimo's kyak, the Italian's felucca, and the bank-fisher's dory. The collection is historical in its character, as it represents the American fishing schooner's development from the earliest times. * * *

The American bank fishing, as carried on with the modern schooners, is very well represented. A full-size dory, with outfit and crew (two men), is particularly interesting. To such a boat belong 5 or 6 trawl lines, each with 500 hooks. Each schooner carries 8 to 12 dories, and the men may have to handle a line more than 20 English miles long with more than 30,000 hooks. In such an effective manner of fishing it may pay to build fishing vessels to the value of $12,000 to $15,000 each. The schooners, as they are built at present, are remarkably fast sailing. Many of them can run up to 13 knots.

It is no wonder that the American fisherman's home shows a comfort, such as I have seen on a large picture, which illustrates such an one. Piano, chandelier, upholstered furniture, carpets, etc., are found in this "fisherman's home," as the inscription reads.

The collection of models gives one the best conception of the great extent of the American fisheries. The whaling steamer cruises through the Arctic seas north and south; the bank fisher is wandering about all over the Atlantic. The mackerel and lobster fisheries require their special types of boats, and so does the herring fishery on the Atlantic coast as well as the oyster fishery. Farther south is carried on the sponge and coral fisheries. Then comes the fisheries on the Great Lakes, on the rivers, and at last the fisheries on the coast of California and Alaska.

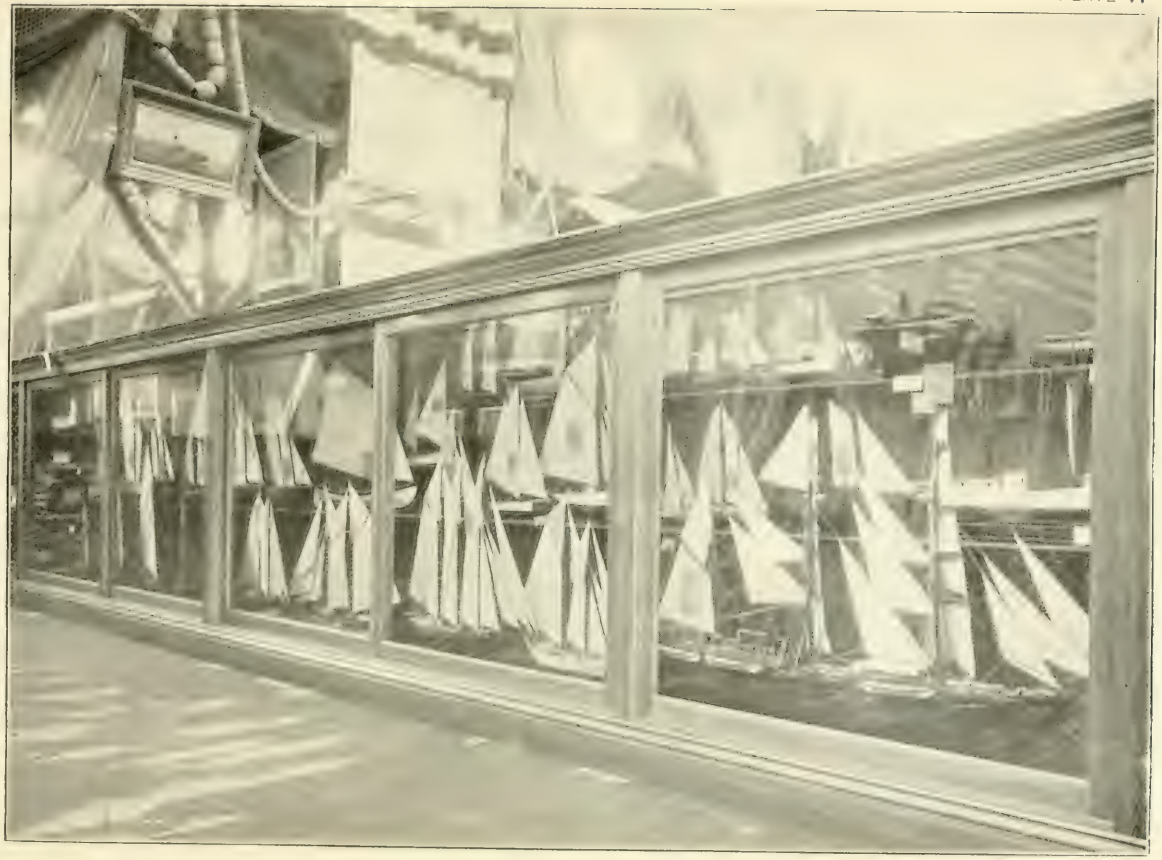
Almost all the world's races, including Chinese and Indians, are engaged in the American fisheries. Many of them still use their aboriginal shapes of boats and fishing gear. In this choice collection is also seen the American fast sailer along with the Chinese junk and Irish cutter.

Among the American fish products is specially to be noticed a dried fish of fine quality (shredded codfish) and in such a state (ground quite fine) that it can be used at once.

Canned salmon from the Pacific shore, smoked halibut, etc., are exhibited here.

Among the by-products are exhibited samples of 20 to 30 kinds of glue made for certain purposes, fish oil, guano, etc. The latter is even ready-made for different purposes—for fields, for grass, for vegetables, and flowers.

As regards hermetically sealed cans, the Americans present an important new method, which may perhaps be valued also with us, where the hermetic (canning) business now is advancing very fast; for example, we will mention the lately started company at Gottenborg. It is the hermetic (can) manufacturer, Max Ams, of New York, who has invented a process to close the cans and boxes without plumbing (soldering) the covers. For this he uses asbestos and caoutchouc as well as specially



MODELS OF AMERICAN FISHING VESSELS AND BOATS.

Photographed by Nyblin.

constructed machines. The result is said to be a considerable saving of time and wages as well as absolute tightness.

Regarding the sport fishery the American exhibition is unsurpassed. The angling rods of steel which are exhibited there are admirable; they are light, elegant, and strong. In one stroke the different parts of the rods are thrown out and also the line; when put together, closed up, it measures 24 to 30 inches. Many different kinds of salmon flies are seen, and trout flies as well.

The fish hatching, into which the Americans have put special effort and which has turned out very satisfactorily, is also well represented. This business is carried on by the United States Fisheries Commission, which expends an annual appropriation of about $500,000.

Early in August a delegation of gentlemen from Aberdeen, Scotland, visited the exhibition at Bergen, for the purpose of studying it, and obtaining knowledge as to its scope and character; also with the object of taking preliminary steps to secure some of the exhibits for the exhibition then talked of for Aberdeen in 1899.

The Aberdeen Daily Free Press of August 19, in commenting upon the arrival home of this delegation, made the following reference to the American exhibit:

They were particularly struck with the splendid fishery exhibits sent over from the United States, which are in charge of Captain Collins, from whom the deputation obtained a great amount of valuable information that may prove useful in connection with the Aberdeen scheme. It is very probable that if it is resolved to proceed with the Aberdeen exhibition, application will be made to the United States to allow these exhibits from Bergen to be shown in Aberdeen.

It is spoken of as large and thoroughly representative, and, the deputation say, would make no inconsiderable show in itself.

Sir Arthur Grant, one of the deputation, in reporting upon the exhibition and the exhibits from various countries, spoke in the following complimentary manner concerning the display of the United States:

We then come to the only real good thing in the fishery part of the exhibition. This, I am glad to say, comes from our American friends. It is of urgent importance, if we are to have an exhibition in Aberdeen, that the whole of this collection should be secured en bloc, and it can with a little notice be well supplemented from across the pond. The United States commissioner, Captain Collins, met us in the exhibition and repeatedly showed us the utmost courtesy and gave us much useful information; so also did his assistant, Mr. Abbott. Most of the exhibits belong to the United States Fish Commission, but some belong to various States, e. g., California. Those which belong to the United States Fish Commission are under the authority of Congress and can only be moved by the authority of that body and by the Executive order of the President.[1]

At an earlier date the lord provost of Aberdeen, in speaking of his observations upon the exhibition while in Bergen, remarked that "the most complete exhibit is from America, under the superintendence of Captain Collins. * * * The American court shows in concrete form the fish and fisheries of America."[2]

[1] The Aberdeen Daily Free Press, August 30, 1898.

[2] The Aberdeen Daily Free Press, August 27, 1898.

A correspondent of the Detroit Free Press (September 11, 1898) wrote as follows:

> Most of the contemporary nations have contributed to the fish exhibits; but were the United States to withdraw hers from the hall, the remaining show would be a decided fizzle. As far as fish and fishing tackle go, our exhibit is really creditable. * * * The United States display of mounted specimens of her native fish, fishing tackle, and models of fishing boats, is really a revelation to even these people who know nothing outside of fish catching, for this is their leading industry.

The News and Herald, of Cleveland, Ohio, stated that "by universal consent the exhibit of the United States exceeded all others from foreign countries, not only in size, but in comprehensiveness and method of installation."

The New York Fishing Gazette says:

> The Norwegian press has been very enthusiastic concerning the American display. More has been written about it than of all the other foreign exhibits put together.
>
> The whole problem of fish and fisheries is carefully and systematically worked out in the arrangement of the objects of the United States. Marine mammals, fish, reptiles, mollusks, and other things that are sought by fishermen are in profusion and large variety. All the various types of boats and vessels employed in the United States fisheries are well represented by models. This collection also shows historically the development of naval architecture as applied to the fisheries since the settlement of America. The old snow, ketch, and ancient schooner from Marblehead contrast strongly with the yachtlike clippers of the present time or the steam whalers that venture far into the Arctic in search of their prey.

Similar statements to those quoted might be multiplied, both from the European and American press, but the extracts given will doubtless suffice to show the general appreciation of what was accomplished by the United States.

COURTESIES.

I have pleasure in acknowledging the following courtesies: The Commissioner of Fish and Fisheries, Hon. George M. Bowers, detailed Mr. William P. Sauerhoff to assist in packing the exhibit, a matter of much moment, since Mr. Sauerhoff is one of the most experienced and accomplished experts in the country in this special line of duty.

Dr. Barton W. Evermann, ichthyologist of the commission, and Mr. W. C. Kendall were also detailed by the Commissioner to make a trip to Chesapeake Bay for the purpose of collecting such fishes as could be obtained there for exhibition as alcoholic specimens, while Mr. Livingston Stone, superintendent of the station at Cape St. Vincent, N. Y., Mr. Clifford G. Corliss, superintendent at Gloucester, Mass., station, and Mr. Frank E. Locke, superintendent at the Woods Hole, Mass., station, were instructed to give me all the aid in their power in collecting and shipping fish to Washington. All of these gentlemen did everything they could in obtaining specimens, and their intelligent zeal made possible the fine exhibit of preserved fish. The expedition conducted by Dr. Evermann was particularly successful; the results exceeded expectation.

I was assigned an office, with proper equipment, at the Fish Commission building, and every facility was cheerfully accorded me for the advancement of the preparatory work by various officials of the commission. The commission's wagon was placed at the disposal of the exhibit when not required for its regular work, and the packages received or dispatched by express for the exhibit were attended to by the Fish Commission as a part of its regular duties, all of which was of great assistance when it was necessary to get the collections ready for shipment at the earliest practicable moment.

The United States National Museum placed at my disposal various collections and manuscripts, that were of great importance to the exhibit.

Dr. David Starr Jordan, president of the Leland Stanford Junior University, Stanford University, Cal., very generously interested himself in obtaining a collection of casts of west coast fishes from the Memorial Park Museum, at San Francisco.

On various occasions Lieut. Robert Platt, U. S. N., on special duty with the United States Fish Commission, most satisfactorily performed certain duties for the exhibit.

Dr. Leonhard Stejneger, of the United States National Museum, assisted the exhibit in certain important matters.

I have pleasure in acknowledging, on behalf of my associates and myself, the assistance and courtesy received from the managers of the exhibition, especially from Mr. Chr. Lehmkuhl, chairman of the executive committee, whose indefatigable labors contributed largely to the success of the exhibition, Dr. J. Brunchorst, and Mr. Herman Friele.

Extended reference has been made elsewhere to the aid and courtesies received from Hon. Chris. Michelsen, president of the exhibition, and Mr. Peter Jessen.

APPENDIX.

PRELIMINARY CATALOGUE AND SYNOPSIS OF THE COLLECTIONS EXHIBITED BY THE UNITED STATES FISH COMMISSION AND BY SPECIAL EXHIBITORS, WITH A CONCORDANCE TO THE OFFICIAL CLASSIFICATION OF THE EXHIBITION.

LIST OF PERSONS ENGAGED IN THE PREPARATION OF THE COLLECTION.

GEORGE M. BOWERS,
United States Commissioner of Fish and Fisheries.

JOSEPH WILLIAM COLLINS,
United States Commissioner to the Exhibition, in general charge.

STAFF.

GEORGE H. H. MOORE, in charge of Fish Culture and Shipments.
W. H. ABBOTT, in charge of Fisheries Collections.
S. A. COLLINS, Secretary, in charge of Accounts, etc.
H. B. BLACKWELL, Typewriter.
FRIMAN KAHES.
W. H. WENTZ.
W. H. JOHNSON.

COLLABORATORS.

HUGH M. SMITH, Chief, Division of Scientific Inquiry, United States Fish Commission.
W. DE C. RAVENEL, Chief, Division of Fish Culture, United States Fish Commission.
CHARLES H. TOWNSEND, Chief, Division of Statistics, United States Fish Commission.
J. H. DUNLAP, Chief Clerk, United States Fish Commission.
BARTON W. EVERMANN, Ichthyologist of the United States Fish Commission.
CHARLES W. SCUDDER, United States Fish Commission.
HECTOR VON BAYER, Chief Architect and Engineer, United States Fish Commission.
LIVINGSTON STONE, Superintendent United States Fish Commission Station, Cape St. Vincent, New York.
CLIFFORD G. CORLISS, Superintendent United States Fish Commission Station, Gloucester, Massachusetts.
E. F. LOCKE, Superintendent United States Fish Commission Station, Woods Hole, Massachusetts.

ARTISTS AND PREPARATORS.

Artist in water colors.—HENRY W. ELLIOTT.
Artist in oil and pastel.—PAUL E. COLLINS.
Artists in painting casts.—A. ZENO SHINDLER, United States National Museum; S. F. DENTON.

Artist in preparing statistical maps, etc.—W. H. BENTON.

Photographers.—T. W. SMILLIE, United States National Museum; CHARLES H. TOWNSEND, S. G. WORTH, United States Fish Commission.

Modelers.—WILLIAM PALMER, United States National Museum; SHERMAN F. DENTON, Wellesley, Massachusetts.

Preparators.—W. P. SAURHOFF, United States Fish Commission; W. H. JOHNSON, C. R. LUSCOMBE, and LAWRENCE JENSEN.

Statistics of certain fisheries of the United States.

[Prepared by the United States Fish Commission.]

States.	Cod.		Herring.		Mackerel.	
	Pounds.	Value.	Pounds.	Value.	Pounds.	Value.
Pacific States (including Alaska):						
Alaska	2,219,835	$55,562	18,700,000	$32,000	.....	.....
Washington	539,000	21,560	617,112	6,817	.....	.....
Oregon	.....	.....	.....	.....	.....	.....
California	2,274,565	56,864	4,486,887	55,796	350,399	$14,159
Total	5,033,400	133,986	23,803,999	94,613	350,399	14,159
New England States:						
Maine	7,786,525	152,036	44,853,220	153,314	2,296,096	102,643
New Hampshire	488,750	8,261	220,000	2,450	87,275	5,340
Massachusetts	69,912,247	1,356,514	20,698,194	198,002	11,641,378	595,894
Rhode Island	365,416	11,098	700	30	188,475	15,736
Connecticut	1,529,863	50,018	.....	.....	65,800	4,817
Total	80,082,801	1,577,927	65,772,114	353,796	14,279,024	724,430
Middle Atlantic States:						
New York	2,277,458	89,921	.....	.....	.....	.....
New Jersey	676,859	20,691	.....	.....	22,907	2,747
Pennsylvania	.....	.....	.....	.....	.....	.....
Delaware	.....	.....	.....	.....	.....	.....
Maryland	.....	.....	.....	.....	.....	.....
Virginia	.....	.....	.....	.....	.....	.....
Total	2,954,317	110,612	.....	.....	22,907	2,747
South Atlantic States:						
North Carolina	.....	.....	.....	.....	.....	.....
South Carolina	.....	.....	.....	.....	.....	.....
Georgia	.....	.....	.....	.....	.....	.....
Florida (east coast)	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....
Gulf States:						
Florida (west coast)	.....	.....	.....	.....	.....	.....
Alabama	.....	.....	.....	.....	.....	.....
Mississippi	.....	.....	.....	.....	.....	.....
Louisiana	.....	.....	.....	.....	.....	.....
Texas	.....	.....	.....	.....	.....	.....
Total	.....	.....	.....	.....	.....	.....
Great Lakes	.....	.....	.....	.....	.....	.....
Grand total	88,070,518	1,822,525	89,576,113	448,409	14,652,330	741,336

Statistics of certain fisheries of the United States—Continued.

States.	Salmon.		Market fishes.	
	Pounds.	Value.	Pounds.	Value.
Pacific States (including Alaska):				
Alaska	12,231,500	$1,219,973		
Washington	21,684,211	551,546	3,140,759	$63,469
Oregon	25,536,701	781,000	2,763,779	39,028
California	4,862,408	179,031	14,190,804	369,631
Total	94,314,820	2,731,550	20,095,342	472,128
New England States:				
Maine	152,740	34,118	17,989,998	244,286
New Hampshire			1,090,300	13,881
Massachusetts	139	68	68,092,741	1,400,499
Rhode Island			9,625,934	224,174
Connecticut	280	222	3,388,126	160,853
Total	153,159	34,408	100,187,099	2,043,693
Middle Atlantic States:				
New York			21,603,849	833,305
New Jersey			31,455,260	1,363,991
Pennsylvania			5,397,848	182,181
Delaware			4,679,711	163,036
Maryland			32,745,537	760,425
Virginia			31,102,404	801,625
Total			126,984,609	4,104,563
South Atlantic States:				
North Carolina			33,226,393	967,764
South Carolina			3,950,605	148,710
Georgia			1,163,556	66,055
Florida (east coast)			6,614,231	196,882
Total			44,954,785	1,379,411
Gulf States:				
Florida (west coast)			24,326,679	506,038
Alabama			1,404,778	46,119
Mississippi			1,825,395	64,368
Louisiana			6,965,582	139,449
Texas			3,718,000	164,200
Total			38,240,434	920,174
Great Lakes			96,619,671	2,270,618
Grand total	94,467,979	2,765,958	427,081,940	11,190,587

Statistics of certain fisheries of the United States—Continued.

States.	Lobster.		Oyster.	
	Pounds.	Value.	Pounds.	Value.
Pacific States (including Alaska):				
Alaska				
Washington			1,154,468	$147,995
Oregon			11,431	3,062
California			1,250,515	698,257
Total			2,416,414	849,314
New England States:				
Maine	10,300,880	$683,082		
New Hampshire	90,300	5,493		
Massachusetts	2,089,502	157,330	338,604	70,946
Rhode Island	774,100	53,762	1,525,749	261,275
Connecticut	1,614,530	101,358	14,911,218	1,432,479
Total	14,869,312	1,001,025	16,775,571	1,764,700
Middle Atlantic States:				
New York	165,093	15,655	18,277,434	2,748,509
New Jersey	143,905	10,861	18,204,291	1,766,648
Pennsylvania			926,660	101,850
Delaware	5,600	285	1,227,324	73,863
Maryland			69,615,406	5,295,866
Virginia			43,134,602	2,524,348
Total	314,598	26,801	151,385,717	12,511,084
South Atlantic States:				
North Carolina			4,977,336	150,845
South Carolina			442,050	23,204
Georgia			1,570,485	40,520
Florida (east coast)			681,450	14,850
Total			7,671,321	229,419
Gulf States:				
Florida (west coast)			2,597,567	98,692
Alabama			3,367,490	107,812
Mississippi			5,645,346	166,672
Louisiana			5,891,095	299,896
Texas			3,085,600	127,990
Total			20,587,098	796,062
Great Lakes				
Grand total	15,183,910	1,027,826	198,836,121	16,150,579

Statistics of the fisheries of the United States, 1897.

[Prepared by the United States Fish Commission.]

State.	Persons employed.	Vessels.			Boats.	
		Number.	Net tonnage.	Value, including outfit.	Number.	Value.
Alabama	1,025	38	387.87	$31,810	496	$20,663
Alaska	2,849	42	9,574.43	505,500	455	66,475
Arkansas	750	.....	.....	.....	561	7,917
California	4,820	66	9,796.87	1,154,685	1,479	124,380
Connecticut	3,047	208	5,269.68	662,252	1,353	98,595
Delaware	2,339	43	569.00	42,510	968	29,754
Florida	7,219	185	2,787.89	470,068	2,379	165,268
Georgia	1,622	23	267.74	26,800	788	9,766
Idaho	57	.....	.....	.....	30	540
Illinois	2,656	4	116.77	18,495	1,694	56,064
Indiana	919	.....	.....	.....	890	8,546
Iowa	944	.....	.....	.....	739	14,797
Kansas	61	.....	.....	.....	61	683
Kentucky	587	.....	.....	.....	639	10,175
Louisiana	5,231	119	896.84	93,527	3,860	213,406
Maine	14,129	408	13,136.67	813,752	5,920	237,469
Maryland	39,443	1,627	34,217.13	1,883,658	9,825	579,308
Massachusetts	17,238	836	59,259.30	4,639,168	3,491	254,033
Michigan	3,351	64	1,380.87	326,928	1,673	103,689
Minnesota	1,075	2	266.52	42,400	703	44,463
Mississippi	2,088	62	570.02	48,759	423	16,856
Missouri	575	.....	.....	.....	523	11,221
Nebraska	76	.....	.....	.....	50	534
Nevada	39	.....	.....	.....	30	600
New Hampshire	365	15	588.05	43,099	73	4,170
New Jersey	10,467	629	7,879.22	873,822	5,618	387,491
New York	14,052	665	9,409.40	1,011,109	6,879	401,686
North Carolina	10,274	128	1,615.59	101,029	3,862	188,375
Ohio	2,353	59	797.26	223,432	967	117,876
Oregon	6,323	23	468.07	54,009	2,022	212,925
Pennsylvania	2,539	61	1,190.44	152,370	888	44,310
Rhode Island	1,757	69	1,484.79	223,735	651	62,743
South Carolina	2,328	15	240.01	29,325	1,227	31,804
South Dakota	121	.....	.....	.....	97	938
Tennessee	520	.....	.....	.....	446	4,879
Texas	1,277	19	240.76	29,710	814	101,570
Utah	630	.....	.....	.....	90	1,175
Vermont	169	.....	.....	.....	56	1,090
Virginia	23,328	943	14,151.87	934,786	9,247	463,722
Washington	6,212	59	1,420.56	160,384	2,646	170,155
West Virginia	67	.....	.....	.....	51	2,630
Wisconsin	2,371	41	654.06	164,092	956	56,894
Total	197,293	6,453	178,637.71	14,711,241	75,722	4,323,635

Statistics of the fisheries of the United States, 1897—Continued.

State.	Other property.	Total investment.	Products.	
			Pounds.	Value.
Alabama	$97,304	$149,777	1,869,400	$227,370
Alaska	1,963,728	2,535,703	64,159,235	2,901,055
Arkansas	28,647	36,564	3,875,858	116,011
California	1,336,469	2,615,534	50,065,734	1,794,729
Connecticut	2,065,987	2,826,834	61,458,221	1,871,413
Delaware	151,965	224,259	7,194,688	250,853
Florida	502,799	1,138,135	37,563,598	1,253,140
Georgia	137,865	174,431	2,994,117	123,563
Idaho	1,835	2,375	235,058	11,929
Illinois	929,693	1,004,252	12,631,505	371,410
Indiana	23,292	31,838	2,746,383	131,567
Iowa	31,913	46,710	4,079,704	124,851
Kansas	2,728	3,411	242,387	11,022
Kentucky	25,319	35,494	2,273,585	90,024
Louisiana	490,282	797,215	27,063,306	852,146
Maine	1,838,572	2,889,793	121,700,200	2,225,806
Maryland	4,932,848	7,345,814	141,177,827	6,460,759
Massachusetts	8,352,028	13,245,229	301,349,331	7,531,194
Michigan	1,243,551	1,674,168	34,019,915	964,279
Minnesota	181,649	268,512	7,307,165	185,649
Mississippi	383,664	449,279	10,345,471	301,793
Missouri	32,981	44,205	3,821,654	119,786
Nebraska	2,187	2,721	340,466	14,015
Nevada	83	683	42,821	3,056
New Hampshire	65,391	112,660	3,956,824	91,481
New Jersey	1,176,167	2,437,480	73,267,434	3,646,382
New York	4,374,140	5,786,935	176,040,903	5,045,560
North Carolina	954,584	1,243,988	51,799,142	1,027,669
Ohio	1,340,650	1,681,958	30,194,846	567,039
Oregon	2,370,478	2,637,412	38,141,632	1,282,036
Pennsylvania	1,117,378	1,314,058	15,045,384	403,886
Rhode Island	733,700	1,020,178	127,365,475	935,144
South Carolina	66,633	127,762	4,944,810	202,602
South Dakota	1,973	2,911	416,920	13,261
Tennessee	25,324	30,203	2,445,291	82,502
Texas	187,842	319,122	7,959,400	313,832
Utah	10,560	11,735	1,230,124	37,479
Vermont	3,704	4,794	208,139	7,160
Virginia	1,447,751	2,846,259	183,993,834	3,647,845
Washington	1,693,930	2,024,469	59,089,527	1,401,433
West Virginia	1,445	4,075	162,021	8,701
Wisconsin	555,998	770,984	21,593,673	529,415
Total	40,945,040	59,919,919	1,596,413,068	47,180,847

COLLECTIVE EXHIBIT OF THE UNITED STATES

ANALYSIS.

Section A. AQUATIC ANIMALS AND PLANTS OF NORTH AMERICA BENEFICIAL OR INJURIOUS TO MAN.

I.—Mammals.

1. Group of sea lions, *Eumetopias stelleri*, with large series of water-color sketches by Henry W. Elliott, and photographs by Charles H. Townsend, illustrating life and habits of the sea lion and the fur seal, *Callorhinus ursinus;* stuffed hair seals.
2. Cast, head of black-fish, *Globicephalus;* photographs and paintings of black-fish and whales.
3. Cast of cow-fish, *Tursiops.*

II.—Birds.

4. Collection of skins of acquatic birds.
5. Mounted acquatic birds.

III, IV.—Reptiles and Batrachians.

6. Alligator, *Alligator mississippiensis;* diamond-backed terrapin, *Melaoclemmys palustris;* red-bellied terrapin, *Pseudemys rugosa;* western terrapin, *Chelopus marmoratus;* hawk's-bill turtle, *Eretmochelys squamata.*
7. Hellbender, *Menopoma alleghenicnsis.*
8. Six species of edible frogs, including five drawings and alcoholic specimen of the giant bullfrog, *Rana catesbiana.*

V.—Fishes.

9. Casts of characteristic fishes, including most of the economic species.
10. Series of water-color paintings of fishes.
11. Series of chromo-lithographs of important species of fishes which have been artificially propagated.
12. Series of photographs of fishes.
13. Series of fishes in alcohol.
14. Representation of fish eggs.

VI.—Mollusks.

15. Series of gastropods useful for food, bait, etc., or injurious to edible mollusks.
16. Collection of plates and diagrams illustrating the embryology of the American oyster.
17. Series of American oysters, illustrating geographical distribution and local variations.
18. Other useful mollusks.
19. Enemies of the oyster.

VII.—Marine and Fresh-water Invertebrates, Exclusive of Mollusks.

20. Collection of economic crustaceans, mainly alcoholic, used as food or bait, etc. It includes the lobster, *Homarus americanus;* spiny lobster or salt-water crayfish, *Panulirus;* common edible crab, *Callinectes hastatus;* rock crab, *Cancer irroratus;* jonah crab, *Cancer borealis;* red crab, *Cancer productus;* Pacific crab, *Cancer magister;* stone crab, *Menippe mercenaria;* prawns, *Pandulus* and *Palæmonetes;* shrimp, *Crangon, Palæmon,* and *Penæus;* horseshoe or king crab, *Limulus,* etc.
21. Collection of economic echinoderms, chiefly dried specimens of star-fish, *Asterias vulgaris,* illustrating the way in which this species attacks the oyster.

Section A. AQUATIC ANIMALS AND PLANTS OF NORTH AMERICA BENEFICIAL OR INJURIOUS TO MAN—Continued.

VII.—Marine and Fresh-water Invertebrates, etc.—Continued.

22. Collection of Florida commercial sponges, and other sponges, containing 53 specimens, including series showing development of sponges by artificial cultivation.

23. Collection of fresh-water crayfishes, *Cambarus* and *Astacus*, occurring within the limits of the United States.

VIII.—Maps of Fishing-Grounds.

24. Series of charts showing the location of oyster beds, etc.

25. Series of general sailing charts, coast and harbor charts, covering the principal North American fishing-grounds; exhibited by the United States Coast Survey and the United States Hydrographic Office.

Section B.—APPARATUS FOR SEA AND FRESH-WATER FISHING.

IX.—Clubs, Spears, Darts, Rakes, and Dredges.

26. Darts, throwing sticks, harpoons, clubs, etc., made and used by the Indians and Eskimos of Alaska, the Northwest coast, and other parts of the United States.

27. Eel spears, porpoise and dolphin grains, sword-fish lily irons, lances, and harpoons used along the Atlantic coast of the United States for the capture of numerous species; halibut killer and gob stick for killing fish and disgorging the hook; squid jigs used to catch squid for bait; mackerel gaff and mackerel bob, formerly used by New England fishermen for the capture of mackerel without the use of bait.

28. Clam rakes, hoes, moss rakes, oyster tongs, deep-water oyster tongs, rakes, scrapes, and dredges.

X.—Fishhooks, Jigs and Drails, Artificial Baits, Flies and Fly Hooks, Gulleters, Clearing Rings, etc.

29. Series of Indian and Eskimo hooks made of bone, wood, and iron.

30. Series of steel hooks, showing the manufacture of hooks from plain wire to the finished hook; and all the principal varieties of fish hooks used in sea and fresh-water fishing, including the Barbless, Limerick, Central-draft, Kirby, Aberdeen, Kinsey, Carlisle, shark, and dog fish hooks.

31. Jigs and drails for the capture of cod, weak-fish, Spanish mackerel, bass, bluefish, and dolphin; mackerel jigs formerly extensively used, with lead, ladles, molds, file, rasp, etc., used in their manufacture.

32. Spoon baits, trolling spoons, spinners, minnows, and insects for salmon, trout, bass, pike, and pickerel fishing.

33. Case of lure baits and ornamental hooks from Alaska.

34. Collection of over 700 varieties of salmon, bass, and trout flies, arranged on cards and labeled with their trade names.

35. Case of insects used for bait and injurious or useful to the fisheries, prepared by Prof. C. V. Riley.

36. Spring hooks for pickerel, "snap and catch'em hooks," Edgar barbless hooks, eagle-claw trap.

37. Bait boxes, creels, gulleters, clearing rings, pocket scales, and other miscellaneous articles used by anglers.

XI.—Fishing Lines and Rigged Gear.

38. Indian and Eskimo lines made of kelp, whale and seal hide, and cedar bark.

39. Cotton lines, shroud laid and cable laid, white and tarred; linen, flax, grass, and silk lines, including waterproof fly lines, and other silk lines for salmon and trout fishing.

Section B. APPARATUS FOR SEA AND FRESH-WATER FISHING Continued.

XI.—Fishing Lines and Rigged Gear—Continued.

40. Spanish gut as imported for the manufacture of leaders; single, double, and twisted gut leaders; minnow gangs, brails, gangings, used in various sea fisheries.

41. Stone, lead, brass, and composition sinkers for nets, seines, and hand lines.

42. Indian and Eskimo floats carved in wood; glass, cork, and wood floats for nets and lines in sea fisheries; wood, cork, and quill floats for pond fishing.

43. Hand lines rigged for cod fishing on the offshore and inshore banks and ledges; pollock hand lines; blue-fish trolling lines; lines for pond fishing; gear for the capture of cat-fish, weak-fish, and others pecies; Indian trawl lines made of cedar; cod, haddock, and halibut trawls in sections and fully rigged with buoys and anchors; snares and eel bobs; Indian fishing lines from Alaska and the Northwest coast.

XII.—Fishing Rods and Reels for Lines and Nets.

44. Rods for salmon, trout, bass, and general fishing, exhibited by the Horton Manufacturing Company.

45. Reels for fly fishing; multiplying reels for trout and salmon; automatic reel; spools, winders, trawl-line rollers, etc.

XIII.—Nets and Seines, and Materials used in their Manufacture.

46. Samples of netting, white and tanned, showing varieties of mesh and kinds of twine.

47. Gill nets, full size, for the capture of shad, mackerel, herring, and other species; gill nets made by the Eskimos from strips of whalebone, etc.

48. Trammel nets for general fishing; models of shad seines; Baird collecting seine, etc.

49. Handle or dip nets and landing nets used in the capture or in handling mackerel, menhaden, trout, and other fish.

50. Oyster dredge and hoisting apparatus, dredge nets, etc.

51. Folding or jerk nets, including models of mackerel purse seines and models of mackerel-seine pocket, etc.

XIV.—Fish Traps, Weirs, and Pounds.

52. Drawings of fish slides and wheels used for catching shad in the rivers of North Carolina; photographs of floating and stationary wheels for catching salmon in the Columbia River.

53. Models of bar weirs and brush weirs used for catching herring in the Bay of Fundy; pound nets, etc.; photographs of various kinds of weirs used for catching herring; pound nets for the capture of salmon, herring, mackerel, and many other species of fishes.

54. Various kinds of fish pots; models of several kinds of lobster pots used on the coast of New England.

XV.—Knives, Gaffs, and Other Apparatus.

55. Indian and Eskimo knives made of stone, bone, and iron for cutting fish and blubber.

56. Cod splitting, ripping, and throating knives; finning and flitching knives; bait-chopping knives; mackerel splitting and reaming or creasing knives; scaling knives, slivering knives, etc.

57. Salmon, cod, haddock, halibut, and mackerel gaffs; halibut cutters; hook used in decapitating fish; fish forks and "pews" used in storing and handling fish.

XVI.—Illustrations of the Fisheries.

58. Series of oil paintings, and sketches, in crayon, illustrating the sea fisheries.

Section B.—APPARATUS FOR SEA AND FRESH-WATER FISHING—Continued.

XVI.—Illustrations of the Fisheries—Continued.

59. Series of more than five hundred photographs, large and small, showing the methods employed in the hand line and trawl line, cod and halibut fisheries, the lobster and other sea fisheries, the fisheries of the Great Lakes, rivers, etc.

Section C.—FISHING VESSELS, BOATS, AND FITTINGS.

XVII.—Vessels and Boats.

60. Series of rigged models and builder's models of all types of vessels used in the American fisheries, past and present.
61. Series of rigged models showing evolution of the New England fishing schooner.
62. Series of models of all important types of boats used in the fisheries; also full-size dory, shad skiff, Aleut bidarka, and Eskimo kaiaks.
63. Series of large photographs showing fishing boats and vessels in different situations.
64. Series of large and small photographs of ship yards and boat shops, illustrating the construction of fishing craft.

XVIII.—Boat Fittings and Appliances.

65. Photographs of sail loft where sails of fishing vessels are made.
66. Nelson's canvas-preserving solution.
67. Anchors, killicks, etc.; oars and paddles.
68. Charts of the United States Coast and Geodetic Survey and the United States Hydrographic Office.

Section D.—FISHERMEN AND ANGLERS.

XIX.—Fishermen and their Apparel.

69. Lay figures of fishermen, showing costumes, implements, methods of work, etc.
70. Photographs, 30 by 40 inches and smaller, showing groups of fishermen of different nationalities, or engaged in the several branches of fishing.
71. Collection of fishermen's oil clothing, etc.

XX.—Shelter, etc.

72. Series of photographs of fishermen's houses, boarding houses, etc.; underground dwellings of Alaskan natives.

XXI.—Habits of Fishermen.

73. Collection illustrating the games, amusements, art work of fishermen; carvings, etc.

XXII.—Fishermen's Tools and Outfits.

74. Fishermen's tools, ditty-boxes, palms, sail needles, etc.

Section E.—APPARATUS USED IN THE WHALING AND SEALING INDUSTRY.[1]

XXIII.—Whaling Vessels and Boats.

75. Model of the steam whaling bark *Orca*, of San Francisco, Cal., fully rigged and equipped, with all sails set and boats at cranes. The *Orca* is the largest whaling vessel in the United States. Builder's model of the sailing bark *Jireh Swift*, one of the vessels burned in the Arctic Ocean by the Confederate cruiser *Shenandoah*.
76. Model of a whaleboat, one-sixth full size, completely equipped for the chase, with sails set and harpoons, lances, oars, etc., in their respective positions.

[1] For convenience of arrangement, there are included here the apparatus of manufacture or preparation of whaling products, the preliminary stages of which, being usually conducted on board of whaling vessels, may be regarded as a portion of the fishery proper.

Section E. **APPARATUS USED IN THE WHALING AND SEALING INDUSTRY**—Cont'd.

XXIV.—Whaling Craft, Harpoons, Guns, and Lances.

77. Series of hand harpoons of various patterns, including the toggle harpoon.
78. Series of guns, including shoulder guns, darting guns, etc.
79. Series of various forms of gun harpoons. These have no commercial value at present, but are interesting, as they constitute a link in the chain that connects the past with the present.
80. Earliest types of hand lances, formerly used exclusively for killing whales; past and present forms of lances for killing seals, sea elephants, and walruses; the old-fashioned, non-explosive gun lance, and the bomb lance, darting bomb, and rocket bomb of the present; also an example of the first bomb lance, according to the records of the United States Patent Office, patented in this country for killing whales.
81. Prussic-acid lance, etc.

XXV.—Cutting Gear.

82. Cutting spade, used for cutting blubber from whales during the process of flensing or "cutting in" a whale.

XXVI.—Aboriginal Whaling and Sealing Apparatus.

83. Series of whaling apparatus used by Indians and Eskimos, including harpoons, lances, etc.

Section F.—**FISHERY PRODUCTS AND THEIR PREPARATION.**

XXVII.—Apparatus and Materials used in the Preparation and Care of Products.

84. Models of welled vessels and boats for keeping fish alive; photographs of fish and lobster cars.
85. Models of ice scoop, fish fork, etc., used in handling ice and fish in packing fresh fish for market or storing them in a vessel's hold; sectional model of fishing schooner, showing arrangement of hold for preserving fish in ice.
86. Photographs of fish wharves, packing and curing houses, showing the appliances for handling, culling, weighing, and packing mackerel and other pickled fish, for curing dry fish, including weighing scales, butts for pickling, flakes for drying, etc.; photographs of smokehouses for curing herring and halibut; of sardine canneries, showing exterior and interior; of salmon canneries; of lobster-boiling house at Boston, showing vats for steaming lobsters; of fish packing and refrigerating houses on the Great Lakes, interior and exterior, with gangs of men at work cleaning fish; of menhaden factory, showing the various apparatus and processes for making oil and guano.
87. Apparatus used in the preparation of boneless fish, including series of knives, nape hooks, etc.; cod-splitting knives, mackerel-splitting knives, menhaden-slivering knives, etc.
88. Series of three large photographs, mostly 30 by 40 inches, showing the manner of handling and curing fish, landing from the vessels, washing, pickling, drying, culling, packing, smoking, etc., also showing the preparation of boneless fish, landing and shipping fresh fish, etc.
89. Series of large photographs showing landing, shucking, packing, and shipping fresh oysters, steaming oysters, and packing them for shipment, etc.

XXVIII.—Products of the Fisheries Prepared for Food.

90. Dry salted or plain dried preparations, including whole and boneless codfish.
91. Smoked preparations, including halibut, herring, finnan haddie, etc.
92. Pickle or brine salted preparations, including mackerel, herring, cods' tongues and sounds, etc.

UNITED STATES EXHIBIT IN ANNEX

Photographed by Nyblin.

Section F.– FISHERY PRODUCTS AND THEIR PREPARATION Continued.

XXVIII.—Products of the Fisheries Prepared for Food—Continued.

93. Preparations in spices, vinegar, etc., including sardines in mustard and tomatoes, mackerel soused and in mustard and tomato sauce, etc.
94. Preparations in oil, including American sardines.
95. Cooked preparations in cans, including mackerel, herring, salmon, lobsters, fish balls, clams, clam chowder, clam juice, etc.

XXIX.—Materials Employed in the Arts and Manufactures.

96. Ivory of mammals, including teeth of sperm whale, *Physeter macrocephalus*, etc.
97. Bone of mammals, including parts of jawbone of whale; bone of fishes, including bill of sawfish, etc.
98. Baleen or whalebone, crude and prepared for various uses, including slabs of whalebone from bowhead whale, *Balæna mysticetus*, northwest coast; right whale, *Eubalæna sieboldii;* strips of bone prepared by the Eskimo and made into nets.
99. Pearls; pearl-yielding shells, with the mother-of-pearl in the rough state and in its various forms to the finished buttons, etc.
100. Leather of the alligator, *Alligator mississippiensis*, salted and tanned and manufactured into satchels, etc.; leather of lizards, sharks, etc., and articles manufactured therefrom (see exhibit of Tiffany & Co.); skins of cod, *Gadus callarias* and other species, crude and manufactured into isinglass and glue. (See exhibit of the Russia Cement Co.)
101. Isinglass, *Ichthyolla*, made from the air-bladders and skins of fishes and used in the manufacture of fine glues and sizes, adhesive and court plasters, diamond cement, table jelly and confectionery, in refining wines and liquors, in adulterating milk, in fixing the luster of artificial pearls, and in lustring silk ribbons; samples of dried sturgeon sounds or bladders; liquid fish glue made from the skins of cod, cusk, hake, and other species; carriage axle and various other articles in the manufacture of which fish glue is used. (See exhibit of the Russia Cement Co.)
102. Specimens of American commercial sponges. (See invertebrate exhibit.)
103. Oils and fats, including blackfish and porpoise-jaw oils, used in lubricating fine machinery, watches, clocks, and guns; whale oils, sperm oil, etc. (See exhibit of Wm. F. Nye.)
104. Fertilizers in the preparation of which fish are used, including guano, made from waste fish products in the preparation of fish glue. (See exhibit of the Russia Cement Co.)

Section G.—FISH-CULTURE.

XXX.—Apparatus and Methods of Fish-Culture.

105. Map showing the location of the hatching stations belonging to the United States Fish Commission.

The following is a list of the hatching stations operated by the United States Fish Commission in 1897:

1. Greenlake, Me., station for collecting eggs of the landlocked salmon (*Salmo salar sebago*), brook trout (*Salvelinus fontinalis*), and the golden brook trout (*Salvelinus pinus aureolus*).
2. Craig Brook, Maine, station for the propagation of the eggs of the Atlantic salmon (*Salmo salar*), brook trout (*Salvelinus fontinalis*), landlocked salmon (*Salmo salar sebago*). In connection with this station a small auxiliary station is operated at Grandlake Stream, Maine, for the collection of eggs of the landlocked salmon (*Salmo salar sebago*).

Section G.—**FISH-CULTURE**—Continued.

XXX.—Apparatus and Methods of Fish-Culture—Continued.

3. St. Johnsbury, Vt., station located 1½ miles from the town of St. Johnsbury, and devoted exclusively to the propagation of the brook trout (*Salvelinus fontinalis*).
4. Gloucester, Mass., station located on Ten Pound Island, in the harbor of Gloucester, and established for the propagation of the marine fishes, chiefly the cod (*Gadus callarias*), pollack (*Pollachius virens*), mackerel (*Scombèr scombrus*), and the lobster (*Homarus americanus*).
5. Woods Hole, Mass., station located in the town of Woods Hole, and devoted chiefly to the propagation of cod (*Gadus callarias*) and lobsters (*Homarus americanus*), though the eggs of several other of the marine fishes are handled, including the flatfish (*Pseudo-pleuronectes americanus*), mackerel (*Scomber scombrus*), tautog (*Tautoga onitis*), and sea bass (*Centropristes striatus*). It is also equipped for biological investigations, and most important scientific work is conducted there each summer.
6. Cape St. Vincent, N. Y., station located on the St. Lawrence River near its mouth; established for the propagation of whitefish (*Coregonus clupeiformis*), pike perch (*Stizostedion vitreum*), and lake trout (*Cristivomer namaycush*). It is utilized also for the hatching of quinnat salmon (*Oncorhynchus tschawytscha*) eggs transferred from the Pacific coast.
7. Battery Station, Maryland, located at the head of the Chesapeake Bay, 4 miles from the town of Havre de Grace, Md., for the purpose of collecting and hatching eggs of the shad (*Alosa sapidissima*), striped bass (*Roccus lineatus*), and white perch (*Morone americana*).
8. Bryan Point, Maryland, station situated on the Potomac River 12 miles below Washington, D. C., and used chiefly for collecting and hatching eggs of the shad (*Alosa sapidissima*).
9. Fish Ponds, Washington, D. C., used for years for the propagation of carp, now chiefly devoted to the rearing of black bass (*Micropterus*), crappie (*Pomoxis annularis*), and shad (*Aloso sapidissima*).
10. Central Station, Washington, D. C. This station is provided with apparatus for the hatching of the eggs of the shad (*Alosa sapidissima*) and Salimonidæ; also as a distributing center for the stations in the vicinity, and as headquarters for the car and messenger service. Attached to the station is a small aquarium used to exhibit fresh and salt water fishes, which also affords opportunity for natural-history study.
11. Wytheville, Va. This station is located 3 miles out of the town of Wytheville, in Wythe County, and is devoted principally to the propagation of the rainbow trout (*Salmo irideus*), rock bass (*Ambloplites rupestris*), black bass (*Micropterus salmoides*), and crappie (*Pomoxis annularis*).

Section G.—FISH-CULTURE—Continued.

XXX.—Apparatus and Methods of Fish-Culture—Continued.

12. Erwin, Tenn. This station was established in 1897 for the propagation of brook trout (*Salvelinus fontinalis*), rainbow trout (*Salmo irideus*), black bass (*Micropterus salmoides*), and crappie (*Pomoxis annularis*), and is located in Unicoi County, 2½ miles from the town of Erwin.

13. Put-in-Bay station is located on the island of Put-in-Bay, in Lake Erie, and is the largest whitefish and pike perch station in the world, having a capacity of 200,000,000 eggs of the whitefish (*Coregonus clupeiformis*) and 500,000,000 eggs of the pike perch (*Stizostedion vitreum*).

14. Northville, Mich., station, located in the town of Northville, 25 miles from Detroit, was established for the propagation of brook trout (*Salvelinus fontinalis*), but during the past year, 1897, over 11,000,000 eggs of the lake trout (*Cristivomer namaycush*) were handled.

15. Alpena, Mich., station, located in the town of Alpena, on Lake Michigan, is devoted exclusively to the collection and hatching of the eggs of the whitefish (*Coregonus clupeiformis*).

16. Duluth, Minn., station is located at the western extremity of Lake Superior, in the town of Duluth, on Lester River, and was established for the collection and hatching of the eggs of the lake trout (*Cristivomer namaycush*), whitefish (*Coregonous clupeiformis*), and pike perch (*Stizostedion vitreum*).

17. Manchester, Iowa, station, located 4 miles from the town of Manchester, is equipped for the collecting and hatching of eggs of the brook trout (*Salvelinus fontinalis*) and rainbow trout (*Salmo irideus*); also for the propagation of bass (*Micropterus salmoides*) and crappie (*Pomoxis annularis*) in ponds.

18. Quincy, Ill., station is for the collection of black bass (*Micropterus salmoides*) and of fishes indigenous to the Mississippi Valley. The ponds for the retention of these fish are located at Meredosia, Ill., 40 miles from Quincy.

19. Neosho, Mo.; a station in the Ozark region of the State of Missouri, for the propagation of rainbow trout (*Salmo irideus*), black bass (*Micropterus salmoides*), and crappie (*Pomoxis annularis*).

20. San Marcos, Tex.; a station established on the San Marcos River, Texas, for the propagation of black bass (*Micropterus salmoides*), rock bass (*Ambloplites rupestris*), and crappie (*Pomoxis annularis*).

21. Leadville, Colo.; a station located on the Rocky Mountains 4 miles from Leadville, and receiving its water supply from Rock Creek. It was established for the propagation of the black-spotted trout (*Salmo mykiss*), the yellow-fin trout (*Salmo mykiss macdonaldi*), and the rainbow trout (*Salmo irideus*). Several million eggs of the brook trout (*Salvelinus fontinalis*) have also been collected and hatched at this station.

Section G.—**FISH-CULTURE**—Continued.

XXX.—Apparatus and Methods of Fish-Culture—Continued.

22. Bozeman, Mont., station is located in the Gallatin Valley, 4 miles from the town of Bozeman, and is devoted to the propagation of the black-spotted or mountain trout (*Salmo mykiss*), the brook trout (*Salvelinus fontinalis*), and the grayling (*Thymallus ontariensis montanus*).

23. Baird station, California, was the first salmon station established on the Pacific coast, and is devoted exclusively to the propagation of the quinnat salmon (*Oncorhynchus tschawytscha*).

(*a*) Battle Creek, an auxiliary station, operated in connection with the Baird station, at which 50,000,000 eggs of the quinnat salmon (*Oncorhynchus tschawytscha*) were collected during the season of 1897.

24. Fort Gaston, Hoopa Valley, California. This station is on the Hoopa Valley Indian Reservation, and is devoted to the propagation of the steelhead trout (*Salmo gairdneri*), the silver salmon (*Oncorhynchus kisutch*), and the quinnat salmon (*Oncorhynchus tschawytscha*). Two auxiliary stations, one at Redwood, Cal., and the other at Corbel, Cal., are also operated in connection with this station.

25. Clackamas station, Oregon. The station is situated on the banks of the Clackamas River, a tributary of the Columbia River, and is devoted to the collecting and hatching of eggs of the quinnat salmon (*Oncorhynchus tschawytscha*). In connection with this station, three auxiliary stations are operated, one at Sandy River, distant 16 miles, one on the Little White Salmon River, in the State of Washington, and one on the Rogue River.

106. Lay figures of two men, one in the act of hauling a shad gill net and the other taking the eggs from a shad in a pan, in which they are to be impregnated. These figures are in a shad gilling skiff, such as is commonly used on the Chesapeake Bay and its tributaries.

107. Model of United States Fish Commission schooner *Grampus*, used in connection with the propagation of cod, lobsters, etc. (see also under head of deep-sea research); photograph, 30 by 40 inches, of the United States Fish Commission steamer *Fish Hawk*, built in 1880, at Wilmington, Del., and used as a floating hatchery during certain seasons of the year.

108. Model of the United States Fish Commission hatching house at Put-in Bay, on Lake Erie, for hatching white fish and other lake species, fitted with "batteries" of hatching jars, etc.; model of the United States Fish Commission hatching house at Gloucester, Mass., for the hatching of cod, haddock, pollock, lobsters, etc. Both of these models were built under the direction of Capt. Joseph W. Collins.

109. Series of large photographs of the most important fish-hatching stations and the most interesting features of fish-cultural work, such as collecting the fish, taking and impregnating the eggs, and the process of manipulating eggs and young fish at the hatchery, rearing fish in troughs, feeding fish in ponds, etc.

Section G.—FISH-CULTURE—Continued.

XXX.—Apparatus and Methods of Fish-Culture—Continued.

110. Model of United States Fish Commission car used for transporting eggs and young fish from the hatcheries to various parts of the country, and for carrying adult fish from one section to another. The commission has four of these cars specially fitted for the transportation of eggs, fry, and fish.

111. Photographs, 30 by 40 inches, of one of the cars and its interior arrangement.

112. Series of fish-hatching apparatus, including all of the important kinds used in the United States. Each specimen in this series is of actual size and in condition for use.

113. Series of accessory apparatus used at fish-hatchery stations, such as pans, dippers, etc.

114. Series of apparatus for the transportation of eggs and young fish. This is what is usually termed a "messenger's outfit," but does not include the full complement of fish cans, which are generally about fifteen in number.

115. Models of fish eggs for the purpose of illustrating the use of fish-cultural apparatus.

116. Prints showing the development of eggs during the process of hatching, including the embryology of the oyster.

117. Series of sponges, showing their development, as a result of artificial culture.

Section H.—INVESTIGATION OF THE WATERS AND RESEARCH.

XXXI.—A.—Deep-sea Research.

118. Model of United States Fish Commission schooner *Grampus;* large photographs of the United States Fish Commission steamers *Albatross* and *Fish Hawk*.

119. Series of nine charts showing the dredging operations of the United States Fish Commission; charts showing the investigation of oyster grounds in the Chesapeake Bay region; series of photographs of fur-seal rookeries on the Pribilof Islands, taken in 1895, showing the condition of seal life on the islands, etc.

B.—Investigation of the Fresh Waters.

120. Maps, prints, and photographs showing investigation of interior waters; collections of fish, crayfish, etc., from the rivers or lakes of the United States.

Section I.—LITERATURE.

XXXII.—Books.

121. Publications of the United States Fish Commission; publications of the United States Government relating to the fisheries; principal works of American writers on the marine and fresh-water fauna of the United States; the geographical distribution, development and life history of aquatic animals, and, generally, investigations upon seas, lakes, and rivers, and their inhabitants.

COLLECTIONS DISPLAYED BY SPECIAL EXHIBITORS.

WILLIAM H. ABBOTT, Washington, D. C.:

Bills of the sawfish, *Pristis pectinatus*.

MAX AMS, New York, N. Y.:

1. Caviare.
2. Pickled eels.
3. Smoked eels.
4. Smoked sturgeon.
5. Stuffed sturgeon.
6. Cans for packing fish, showing that cans can be made air-tight without the use of solder.

A. H. BALDWIN, Washington, D. C.:

Pen-and-ink drawings of edible frogs.

J. W. BEARDSLEY'S SONS, 179-180 West street, New York, N. Y.:

1. Shredded codfish.
2. Boneless herring.

MARCUS BENJAMIN, 1710 N street, Washington, D. C.:

Series of portraits and autographic letters of the presidents of the American Association for the Advancement of Science from 1848 to 1898, the first half century of its existence. The complete list is as follows:

William C. Redfield	1848	Julius Erasmus Hilyard	1875
Joseph Henry	1849	William Barton Rogers	1876
Alexander Dallas Bache	1850	Simon Newcomb	1877
Louis Agassiz	1851	Othniel Charles Marsh	1878
Benjamin Pierce (letter only)	1853	George Frederick Barker	1879
James Dwight Dana	1854	Lewis Henry Morgan	1880
John Torrey	1855	John William Dawson	1882
James Hall	1856	Charles Augustus Young	1883
Jacob Whitman Bailey	1857	John Peter Lesley	1884
Alexis Caswell	1857	Hubert Anson Newton	1885
Jeffries Wyman (portrait only)	1858	Edward Sylvester Morse	1886
Isaac Lea	1860	Samuel Pierpont Langley	1887
Frederick Augustus Porter Barnard	1866	John Wesley Powell	1888
John Strong Newberry	1867	Thomas Corwin Mendenhall	1889
Benjamin Apthorp Gould	1868	George Lincoln Goodale	1890
John Wells Foster	1869	Albert Benjamin Prescott	1891
William Chauvenet	1870	Joseph Le Conte	1892
Thomas Sterry Hunt	1870	William Harkness	1893
Asa Gray	1871	Daniel Garrison Brinton	1894
John Lawrence Smith	1872	Edward Williams Morley	1895
Joseph Lovering	1873	Edward Drinker Cope	1896
John Lawrence Le Conte	1874	Theodore Nicholas Gill	1897
		Wolcott Gibbs	1898

W. H. BENTON, Washington, D. C.:

Statistical charts of United States fisheries, and the fish-cultural work of the United States Fish Commission.

FISHERY PRODUCTS UNITED STATES EXHIBIT.

Photographed by Nyblin.

G. B. BORDEN, Acushnet, Mass.:

Gill net made of strips of baleen or black bone from the polar whale (probably *Balæna mysticetus*) by the Eskimos of northern Alaska. Used for fishing through the ice. Net is about 40 feet long and 3½ feet deep; mesh 2½ inches.

It is stretched across a stream when the fish are running down to the sea. The bone net is superior to a net made of twine for the conditions under which it is used. In extremely cold weather one made of twine soon becomes so clogged with ice that it is useless, while one made from bone needs only a vigorous shake to free it from clinging ice, when it is again ready for use.

BRISTOW & DIXON, Stormont, Va.:

Deep-water oyster tongs.

F. E. BROWN, 12 William street, New Bedford, Mass.:

Collection of whaling apparatus.

1. Darting gun and bomb lance.
2. Pierce harpoon for darting gun.
3. Wooden model of harpoon.
4. Darting harpoon, gun attached.
5. Brown's shoulder bomb gun.
6. Wire-shank harpoon
7. Allen's gun harpoon.
8. Freeman's bomb harpoo
9. Toggle harpoon.
10. Brown's gun harpoon.
11. Brown's gun harpoon.
12. Double-action harpoon.
13. Barker's bomb harpoon.
14. Single-barb harpoon.
15. Two-barbed harpoon.
16. Brown's bomb lance.
17. Prussic-acid lance.
18. Egger's explosive bomb.
19. Pierce's bomb lance, rubber guides.
20. Pierce's bomb lance, metallic guides.
21. Pierce's bomb for darting gun.
22. Pierce's first patent bomb lance for darting gun.
23. Brand's bomb lance.
24. Toggle harpoon for Pierce's darting gun.
25. Pierce's darting-gun harpoon.
26. Pierce's muzzle-loading darting gun.
27. Pierce's darting harpoon gun.
28. Cunningham and Cogan's bomb gun.
29. Cunningham's darting gun.

PAUL E. COLLINS, 1323 Washington street, Boston, Mass.:

Series of paintings and pastels illustrating methods of fishing; portrait of Hon. George M. Bowers, United States Commissioner of Fish and Fisheries.

SHERMAN F. DENTON, Wellesley, Mass.:

Casts and mounted skins of fishes.

F. F. DIMICK, 3 Long Wharf, Boston, Mass.:

Reports of the Boston fish bureau.

HENRY W. ELLIOTT, Cleveland, Ohio:

Series of over 100 water-color paintings of Alaska, including a large collection showing the life and habits of the fur seal (*Callorhinus ursinus*), its breeding grounds on the Pribilof Islands, methods of driving and killing it, etc.

1. Entrance to the Straits of Fuca.
2. Steaming through Portland Canal.
3. Baranof Island, Sitka Sound.
4. Town of Sitka.
5. Mount Verstovia, from Sitka.
6. Mount Kruzof, Sitka Sound.
7. Baranof Castle.
8. Fairweather and Crillon mountains.
9. The island of Kadiak.
10. Sathalidak heads, Kadiak Island.
11. Kahgook, Kadiak Island.
12. Surround of the otter, Kadiak Island.
13. An extended glimpse of the Aleutian chain
14. Volcanoes of Pogromni and Shishaldin.
15. Study of volcano rocks, Kahlecta Point.
16. Akun Island, Aleutian chain.
17. Oogalgan Island, Aleutian chain.
18. Glimpse of Shishaldin, from Bering Sea.
19. "The Bishop," Kahlecta Point.
20. Unalaskan snow squalls.
21. Waterfall Head, Unalaska Harbor.
22. Vesolia Mees, Unalaska Island.
23. Volcano of Makushin, Unalaska Island.
24. Volcano of Makushin, from Oolachta Harbor.
25. Unalaska heads, from the village.
26. Interior of Unalaska Island.
27. Unalaska village and mountains.
28. Bogoslof, Bering Sea.
29. The island of St. George.
30. The Reef Point, St. Paul village.
31. English Bay, St. Paul Island.
32. Fur seals fighting.
33. Vanquished bull.
34. Seal-breath fog.
35. Village Hill, St. Paul Island.
36. East landing, St. Paul Island.
37. Stroll on Lukannon Beach.
38. Reef rookery, St. Paul Island, 1872.
39. Polavina rookery.
40. Tolstoi seal grounds.
41. Seal pups podding.
42. Fur seals approaching rookeries.
43. Fur seals hauling.
44. Hauling grounds, English Bay, St. Paul Island, 1872.
45. Sea-lion rookery.
46. Sea-lion rookery at Tolstoi, St. Paul Island.
47. Sea-lion pen.
48. Drive of sea lions.
49. Natives driving fur seals to killing ground, St. Paul Island, 1872.
50. Natives and fur-seal drive.
51. Killing fur seals, 1872.

HENRY W. ELLIOTT, Cleveland, Ohio—Continued.

52. Killing seals.
53. Natives skinning seals.
54. Loading skins.
55. Natives and Bidarrah egging.
56. Netting Choochkies, St. Paul.
57. New village, St. Paul, 1878–1891.
58. Old village, St. Paul, 1786–1876.
59. Village of St. George.
60. Village of St. Paul.
61. The south shore of St. George Island.
62. The east shore of St. George Island.
63. The east rookery of St. George Island.
64. The north shore of St. George Island.
65. Starry arteel rookery, St. George Island.
66. Zapadnie, looking north, St. George Island.
67. Zapadnie, looking south, St. George Island.
68. The island of St. Paul.
69. The north shore of St. Paul.
70. Lukannon sands, St. Paul.
71. Polavina rookery, St. Paul.
72. Northeast point and sand dunes.
73. Killing grounds and landing, St. Paul Island.
74. Sea lion neck, St. Paul Island.
75. English Bay seal grounds, 1890.
76. English Bay seal grounds, July 18, 1872.
77. Lukannon rookery.
78. Zapadnie rookery, St. Paul Island.
79. The lagoon and village, St. Paul Island.
80. Katavie rookery.
81. Reef and Garbotch rookeries.
82. English Bay sands.
83. Tolstoi rookery.
84. A herd of fur seals in waiting.
85. Group of sea lions.
86. Walrus Island, Pribilof group.
87. Otter Island.
88. Otter Island.
89. Polar bears on Halls Island, near St. Matthew Island.
90. Cape Upright, St. Matthew Island.
91. Magnet Head, St. Matthew Island.
92. St. Matthew Island, from Magnet Head.
93. Pinnacle Islet, near St. Matthew Island.
94. The Bishop and his Thumb, St. Matthew Island.
95. Banded Point, St. Matthew Island.
96. Northeast Cape, St. Lawrence Island.
97. Innuits stacking frozen hair seals.
98. The Diomedes, Bering Strait.
99. Innuit huts, Lower Kuskokwim River.
100. Cape Prince of Wales.
101. Portion of the tundra, St. Lawrence Island.
102. Point Barrow, Alaska.
103. Sealers off Shishaldin, Pacific Ocean.
104. St. Matthew Island.
105. Old Sitka, October, 1866.

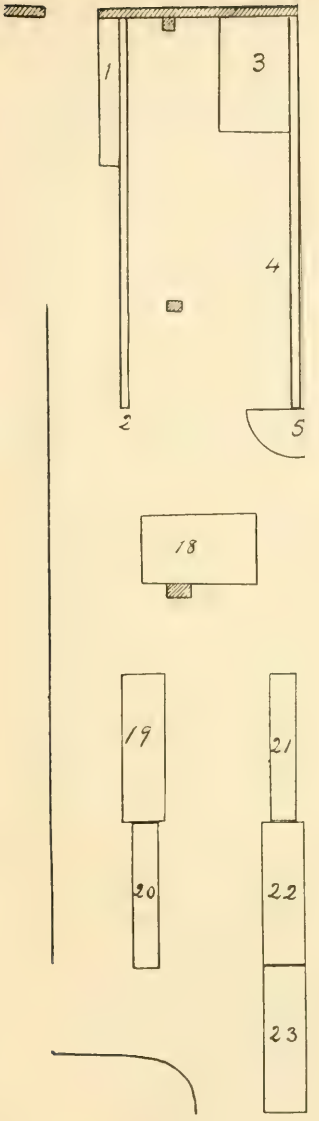
ENTERPRISE MANUFACTURING COMPANY, Philadelphia:

Meat and bait chopper.

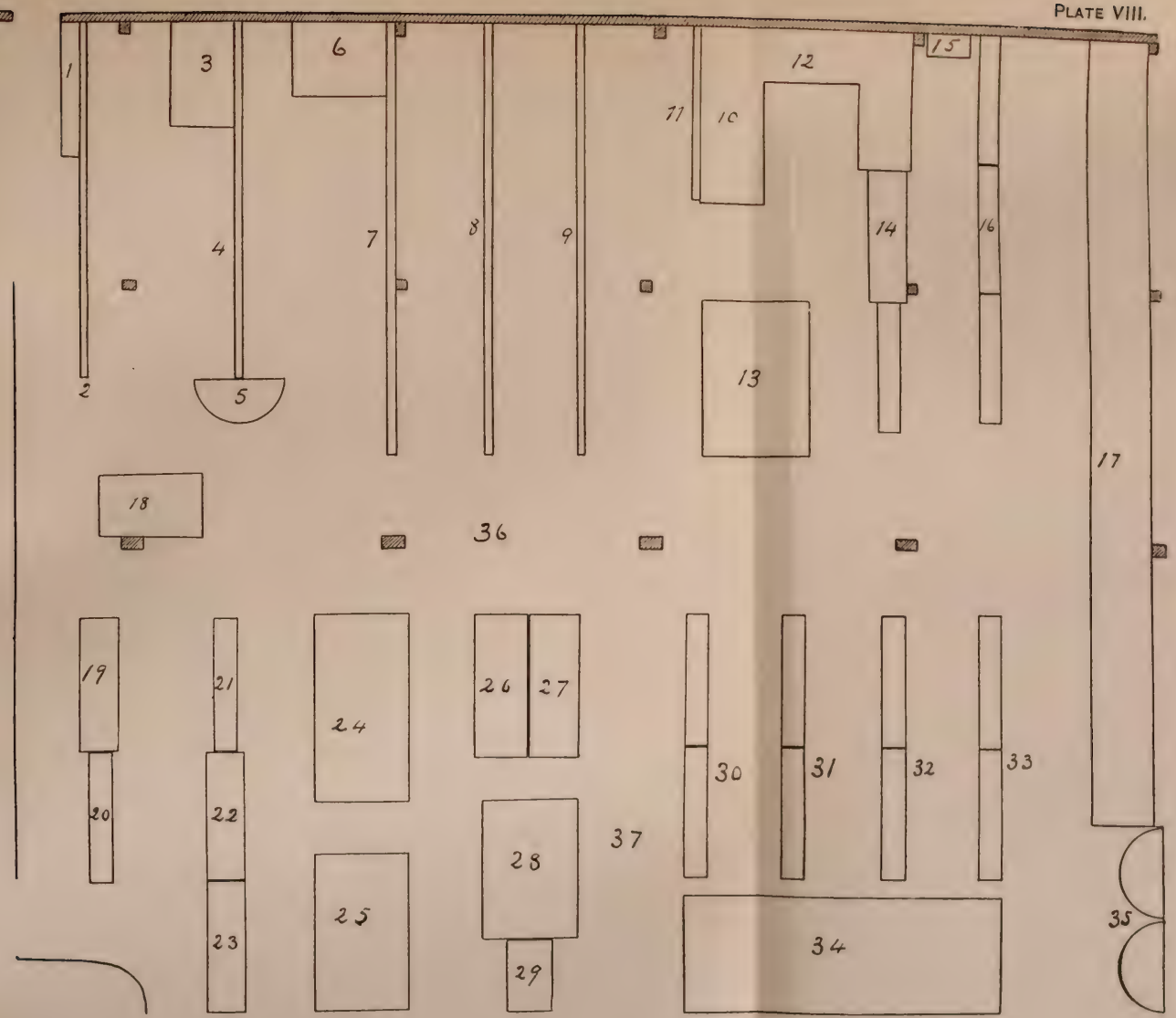
BARTON WARREN EVERMANN, Ph. D., ichthyologist, United States Fish Commission

List of papers on the fishes of America:

1. A Review of the Species of *Gerres* Found in American Waters, by B. W. Evermann and Seth E. Meek. (Proc. Ac. Nat. Sci. Phila. 1883, 116–124.)
2. List of Fishes Collected in Harvey and Crowley Counties, Kans., by Barton W. Evermann and Morton W. Fordice. (Proc. Ac. Nat. Sci. Phila. 1885, 412.)
3. List of Fishes Collected in Harvey and Cowley Counties, Kans., by Barton W. Evermann and Morton W. Fordice. (Bull. Washburn College Lab. Nat. Hist. 1885, 184–186.)
4. A List of the Fishes Observed in the Vicinity of Brookville, Franklin County, Ind. (Bull. 2, Brookville Soc. Nat. Hist. 1886, 3–11.)
5. Notes on a Collection of Fishes from the Monongahela River, by Barton W. Evermann and Charles H. Bollman. (Proc. N. Y. Ac. Sci. 1886, 335–340.)
6. The Food Fishes of Indiana, by David S. Jordan and Barton W. Evermann. (Rept. Ind. State Board Horticulture 1886, 156–173.)
7. A Revision of the American Species of the Genus *Gerres*, by Barton W. Evermann and Seth E. Meek. (Proc. Ac. Nat. Sci. Phila. 1886, 256–272.)
8. Description of Six New Species of Fishes from the Gulf of Mexico, with Notes on Other Species, by David S. Jordan and Barton W. Evermann. (Proc. U. S. Nat. Mus. 1886 (Nov. 26, 1886), 466–476.)
9. Description of Eighteen New Species of Fishes from the Gulf of California, by Oliver P. Jenkins and Barton W. Evermann. (Proc. U. S. Nat. Mus. 1888 (July 2, 1888), 137–158.)
10. Notes on Indiana Fishes, by Barton W. Evermann and Oliver P. Jenkins. (Proc. U. S. Nat. Mus. 1888, 43–57.)
11. Report upon a Collection of Fishes made at Guaymas, Sonora, Mexico, with Descriptions of New Species, by Barton W. Evermann and Oliver P. Jenkins. (Proc. U. S. Nat. Mus. 1891, 121–165, Pls. I, II.)
12. Description of a New Species of Fish from Tippecanoe River, Indiana, by David Starr Jordan and Barton Warren Evermann. (Proc. U. S. Nat. Mus. 1890, 3–4.)
13. Two-Ocean Pass. (Proc. Ind. Ac. Sci. 1893, 29–34.)
14. The Work of the United States Fish Commission Steamer *Albatross* in the North Pacific and Bering Sea in 1892. (Proc. Ind. Ac. Sci. 1892, 56–57.)
15. The Ichthyologic Features of the Black Hills Region. (Proc. Ind. Ac. Sci. 1892, 73–78.)
16. The Work of the United States Fish Commission and its Relation to the Farmer, by Barton Warren Evermann. (Rept. Indiana Fish Comm. 1893–94, 15–25.)
17. The Fishes of the Missouri Basin, by Barton W. Evermann and J. T. Scovell. (Proc. Ind. Ac. Sci. 1895, 125–130.)
18. Recent Investigations concerning the Redfish, *Oncorhynchus nerka*, at its Spawning Grounds in Idaho, by Barton W. Evermann and J. T. Scovell. (Proc. Ind. Ac. Sci. 1895, 131–134.)
19. Description of a New Species of Pipefish (*Siphostoma scovelli*) from Corpus Christi, Tex., by Barton W. Evermann and William C. Kendall. (Proc. U. S. Nat. Mus. 1895, 113–115.)



1. Model of U. S. transport *Merrimac*
2. Screen, with casts and paintings c
3. Charts.
4. Screen, with fish casts and paintir
5. Swinging screens.
6. Models of whaling scenes.
7. Screen, with whaling apparatus, p
8. Screen, with views of fishing towr
9. Screen, with photographs of meth
10. Models of weirs.
11. Screen, with views of net making
12. Models of pound nets.
13. Oyster and clam rakes and dredge
14. Cases, with oil clothes, nets, twine
15. Bait and meat chopper.
16. Cases containing fishing apparatus
17. Large case for models of vessels ar
18. Group of hair seals.
19. Casts of fish and literature.



PLAN OF UNITED STATES EXHIBIT IN MAIN BUILDING.

1. Model of U. S. transport *Merrimac*.
2. Screen, with casts and paintings of fish.
3. Charts.
4. Screen, with fish casts and paintings of Alaskan seal herds.
5. Swinging screens.
6. Models of whaling scenes.
7. Screen, with whaling apparatus, paintings, etc.
8. Screen, with views of fishing towns, and methods of fishing.
9. Screen, with photographs of methods of fishing.
10. Models of weirs.
11. Screen, with views of net making and methods of fishery.
12. Models of pound nets.
13. Oyster and clam rakes and dredges.
14. Cases, with oil clothes, nets, twine, etc
15. Bait and meat chopper.
16. Cases containing fishing apparatus.
17. Large case for models of vessels and boats.
18. Group of hair seals.
19. Casts of fish and literature.
20. Unmounted fish-eating birds.
21. Fish casts.
22. Fish casts and sponges.
23. Mounted birds, alligator skins, etc.
24. Alcoholic exhibit of fish and reptiles.
25. Sea lions and fur seal.
26. Alligator.
27. Oysters.
28. Oysters and other mollusca; crustaceans; utilization of river muscles.
29. Tiffany's exhibit of pearls, etc.
30. Rigged fishing gear, lines and reels.
31. Rigged fishing gear.
32. Hooks: Angler's flies, etc.
33. Hooks: Aboriginal and modern.
34. Platform for trawler's dory.
35. Swinging screens of photographs.
36. Main aisle through United States section.
37. Cross aisle.
38. Main aisle through building between exhibits of Sweden and United States.

BARTON WARREN EVERMANN, Ph. D., etc.—Continued.

List of papers on the fishes of America—Continued.

20. The Whitefishes of North America, by Barton W. Evermann and Hugh M. Smith. (Rept. U. S. Fish Comm. 1894, 283–324, pls. 11–28.)
21. Report upon the Fishes of the Missouri River Basin, by Barton W. Evermann and Ulysses O. Cox. (Rept. U. S. Fish Comm. 1894 (Nov. 27, 1896), 325–429.)
22. An Annotated List of the Fishes known from the State of Vermont, by B. W. Evermann and W. C. Kendall. (Rept. U. S. Fish Comm. 1894 (Nov. 27, 1896), 579–604.)
23. Description of a New Species of Shad (*Alosa alabamæ*) from Alabama. (Rept. U. S. Fish Comm. 1895 (Dec. 28, 1896), Appendix 4, 203–205.)
24. A Check List of the Fishes and Fish-like Vertebrates of North and Middle America, by David Starr Jordan and Barton Warren Evermann. (Rept. U. S. Fish Comm. 1895 (Dec. 28, 1896), Appendix 5, 207–584.)
25. Report on the Fisheries of Indian River, Florida, by Barton W. Evermann and Barton A. Bean. (Rept. U. S. Fish Comm. 1896 (1897), Appendix 5, 223–262, pls. 23–59.)
26. The Fish and Fisheries of the Coastal Waters of Florida. (Senate Document No. 100, 54th Congress, 2d Session, 1897, 1–80.)
27. Notes on Fishes Collected by E. W. Nelson on the Tres Marias Islands and in Sinaloa and Jalisco, Mexico. (Proc. Biol. Soc. of Wash. 1898, 1–3, Jan. 27, 1898.)
28. Report on the Establishment of Fish-cultural Stations in the Rocky Mountain Region and Gulf States. (Articles 1 and 2, Bull. U. S. Fish Comm. 1891 (May 25, 1892), 1–90, pls. I–XXXVI.)
29. Description of a New Sucker, *Pantosteus jordani*, from the Upper Missouri Basin. (Article 2, Bull. U. S. Fish Comm. 1892 (Jan. 27, 1893), 51–56.)
30. The Fishes of Texas and the Rio Grande Basin, considered chiefly with reference to their Geographic Distribution, by Barton W. Evermann and William C. Kendall. (Article 3, Bull. U. S. Fish Comm. 1892 (Feb. 6, 1894), 57–126, pls. X–L.)
31. The Investigation of Rivers and Lakes with Reference to the Fish Environment. (Bull. U. S. Fish Comm. 1893, 69–73.)
32. A list of the Species of Fishes Known from the Vicinity of Neosho, Missouri, by B. W. Evermann and W. C. Kendall. (Articles 22 and 23, Bull. U. S. Fish Comm. 1894 (May 23, 1895), 469–472.)
33. The Fishes of the Colorado Basin, by B. W. Evermann and Cloud. Rutter. (Articles 22 and 23, Bull. U. S. Fish Comm. 1894 (May 23, 1895), 473–486.)
34. The Salmon Fisheries of the Columbia River Basin, by C. H. Gilbert and B. W. Evermann. (Article 16, Bull. U. S. Fish Comm. 1894 (Aug. 27, 1894), 153–207, pls. 13–25.)
35. A Preliminary Report upon Salmon Investigations in Idaho in 1894. (Article 2, Bull. U. S. Fish Comm. 1895 (Feb. 20, 1896), 253–184.)
36. The Fishes of the Neuse River Basin, by Barton W. Evermann and Ulysses O. Cox. (Article 4, Bull. U. S. Fish Comm. 1895 (March 2, 1896), 303–310.)
37. A Report upon Salmon Investigations in the Headwaters of the Columbia River, in the State of Idaho, in 1895, together with Notes upon the Fishes Observed in that State in 1894 and 1895. (Article 2, Bull. U. S. Fish Comm. 1896 (1897), 149–202, pls. 67–72.)

BARTON WARREN EVERMANN, Ph. D., etc.—Continued.

List of papers on the fishes of America—Continued.

38. A Report upon Salmon Investigations in the Columbia River Basin and Elsewhere on the Pacific Coast in 1896, by Barton Warren Evermann and Seth Eugene Meek. (Article 2, Bull. U. S. Fish Comm. 1897 (Jan. 6, 1898), 15–84, pls. 1 and 2, and 6 text figures.)
39. Descriptions of New or Little Known Genera and Species of Fishes from the United States, by Barton W. Evermann and William C. Kendall. (Article 5, Bull. U. S. Fish Comm. 1898 (Feb. 9, 1898), 125–133, pls. 6–9.)
40. The Fishes of North and Middle America: A Descriptive Catalogue of the Species of Fish-like Vertebrates found in the Waters of North America, north of the Isthmus of Panama, by David Starr Jordan and Barton Warren Evermann. (Published as Bulletin No. 47, U. S. National Museum, in 4 octavo volumes (3 of text and 1 of plates), of more than 3,000 pages and 700 plates. Vol. 1 published in 1896, the other volumes in 1898.)
41. The Fish Fauna of Florida. (Bull. U. S. Fish Comm. 1897.)

MARY A. GARDNER, Miami, Fla.:

Fish-scale jewelry, etc.

CALVIN V. GRAVES, Natural Bridge, N. Y.

Trolling bait.

Protected live-fish bait. An annealed, flanged, flint-glass tube, into which a live minnow is placed, the tube being so arranged as to magnify the minnow; hole in each end to keep the bait alive. Three sets of white hooks—one treble hanging from lower end of tube and two double from upper end on opposite sides; piano-wire leader and white swivel. Sizes 1 and 2. Tubes 3½ and 4 inches long.

Only the minnow is seen in a foot of water. Angleworms, crabs, grasshoppers, or any bait can be used.

MONROE A. GREEN, 125 Broadway, Rochester, N. Y.:

Samples of barbless hooks, made by Mr. Green for trout and bass fishing.

Box for transportation of fish ova.

THE W. J. HOOPER MANUFACTURING CO., Baltimore, Md.:

1. Gill nets for the capture of various kinds of fish.
2. Samples of white and tanned netting, showing kind of twine, size of mesh, etc.
3. Models of pound nets, floating traps, etc.
4. Model of fyke net.

THE HORTON MANUFACTURING CO., Bristol, Conn.:

1. Bristol steel fishing rods.
2. Bass rod, full nickel-mounted, plain maple handle.
3. Bass rod, full nickel-mounted, with plain maple handle.
4. Fly rod, full nickel-mounted, telescoped, plain maple handle.
5. Fly rod, full nickel-mounted, telescoped, plain maple handle.
6. Fly rod, full nickel-mounted, telescoped, plain maple handle.
7. Fly rod, full nickel-mounted, jointed, plain cork-grip handle.
8. Henshall bass rod, nickel-mounted, plain maple handle.
9. Henshall bass rod, nickel-mounted, celluloid-wound, double-grip handle.
10. Bass rod, nickel mountings, solid agate tip, white celluloid-wound handle.
11. St. Lawrence bass rod, full nickel-mounted, silver three-ring tip, plain maple handle.
12. Rangely fly rod, full nickel-mounted, one-ring fly tip, cork-grip handle.

THE HORTON MANUFACTURING CO., Bristol, Conn.—Continued.

13. Favorite bait casting rod, full nickel-mounted, solid German-silver double-hole tip, cane-wound handle.

Glove-leather cases for Bristol fishing rods. Five sizes: Nos. 4, 8, 9, 11, 13, and 16.

CHARLES B. HUDSON, Washington, D. C.:

1. Painting of fleet of American schooners fishing for mackerel with hook and line; entitled "Mackerel fishing in the fifties."
2. Pen-and-ink drawings of fishing vessels.

GEORGE E. JENNINGS, 203 Broadway, New York, N. Y.:

Bound volumes of the Fishing Gazette, from 1892 to 1897, inclusive.

Book of recipes for cooking fish.

DAVID S. JORDAN, President of the Leland Stanford Junior University, Stanford University, Cal.:

Publications upon American fish and fisheries, etc.

H. & G. W. LORD, Boston, Mass.:

1. Model of mackerel purse seine.
2. Model of drag seine, with bunt pocket.
3. Model of gill net.
4. Samples of white and tanned netting, showing different kinds of twine and sizes of mesh used for various purposes.
5. Collection of twines for making nets.

GEORGE FREDERIC KUNZ, New York, N. Y.:

Publications on pearls.

L. D. LOTHROP, Gloucester, Mass.:

Collection of models and full-size specimens of fishing apparatus, etc., as follows:

Candleholder.
Cod splitter.
Cutthroaters.
Dory scoop (model).
Dory knife.
Eel spear.
Fish forks (model).
Fog horn (model).
Fish gaff (model).
Fishing sinkers for hand lines.
Fishing sinkers.
Georges hand-line swivel.
Hand-line swivels.
Haddock ripper.
Ice scoop (model).
Improved snap hook.
Line splicer.
Mackerel splitter.
Mackerel plow.
Mackerel jigs.
Net swivels.
Paint scraper.
Patent swivel.
Swordfish dart.
Skinning knife.

L. D. LOTHROP, Gloucester, Mass.—Continued.

Collections of models, etc.—Continued.

Small lead sinkers.
Spreaders.
Sail needles.
Squid jigs.
Sucker spears.
Trawl swivel.
Thole pin.
Trawl swivel.
Trawl roller (model).

THOMAS F. McMANUS, Boston, Mass.:

1. Models of fishing vessels.
2. Model of pilot schooner.
3. Photographs of fishing schooners.

GEORGE MARSHALL, Laurel, Md.:

Collection of aquatic birds—

1. Bonaparte's gull, *Larus Philadelphia*. 1 specimen.
2. Least tern, *Sterna antillarum*. 1 specimen.
3. Hooded merganser, *Lophodytes cucullatus*. 1 specimen.
4. Mallard, *Anas boschas*. 1 specimen.
5. Black duck, *Anas obscura*. 1 specimen.
6. Blue-wing teal, *Anas discors*. 1 specimen.
7. Wood duck, *Aix sponsa*. 2 specimens.
8. Great blue heron, *Ardea herodias*. 1 specimen.
9. Green heron, *Ardea virescens*. 2 specimens.
10. King rail, *Rallus elegans*. 2 specimens.
11. Virginia rail, *Rallus virginianus*. 1 specimen.
12. Sora, *Porzana carolina*. 2 specimens.
13. American woodcock, *Philohela minor*. 1 specimen.
14. Wilson's snipe, *Gallinago delicata*. 1 specimen.
15. Pectoral sandpiper, *Tringa maculata*. 1 specimen.
16. Greater yellow legs, *Totanus melanoleucus*. 1 specimen.
17. Bartramian sandpiper, *Bartramia longicauda*. 2 specimens.
18. Spotted sandpiper, *Actitus macularia*. 1 specimen.
19. Golden plover, *Charadius apricarius*. 1 specimen.
20. Belted kingfisher, *Ceryle alcyon*. 2 specimens.

MEMORIAL MUSEUM, Golden Gate Park, San Francisco, Cal.:

Eighty-seven gelatine casts of Pacific coast fishes.

B. C. MILAM & SON, Frankfort, Ky.:

Collection of Kentucky fishing reels—

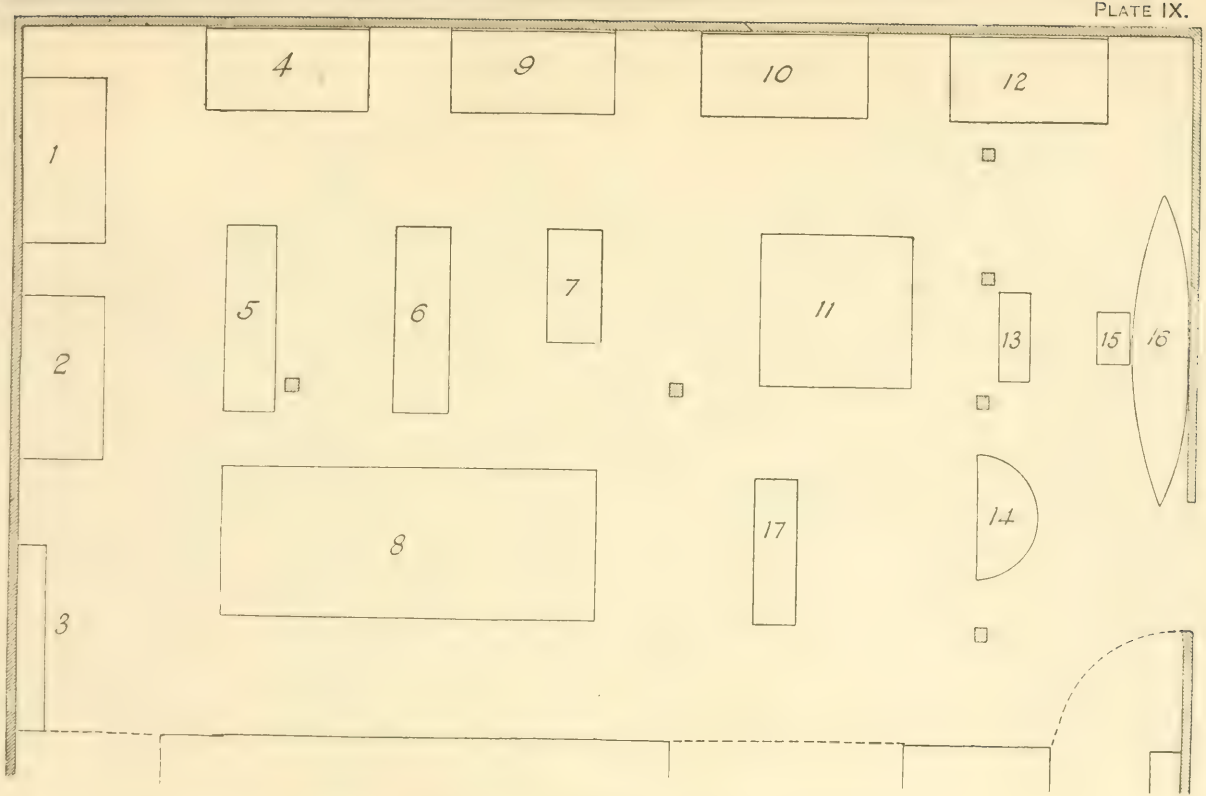
1. Trout reel. A small real that will hold ample line for trout fishing.
2. Black-bass reel. It holds from 86 to 100 yards of line, and is an ideal black-bass reel.
3. General utility reel. Used for trout, bass, and salmon fishing.
4. Salmon or lake reel. Used for salmon and heavy lake fishing.
5. Sea-bass reel. Used for same fishing as No. 4, but is larger and stronger, and specially suited to sea fishing.

GEORGE H. H. MOORE, Washington, D. C.:

Specimen of fossil fish.

JOHN R. NEAL & CO., Boston, Mass.:

Smoked fish, including finnan haddie.



PLAN OF UNITED STATES EXHIBIT IN ANNEX.

1, 2, 4. Canned and smoked fish.
3. Oils and isinglass.
5. Exhibits of Preservaline Company and Russian Cement Company.
6. Exhibits of Russian Cement Company and Max Ams.
7. Gloucester fish-hatching station.
8. Group showing methods of catching and spawning shad.
9, 10. Fish-hatching apparatus.
11. Put-in Bay fish-hatching station.
12. Messenger's outfit.
13. Model of United States Fish Commission car.
14. Swinging screens.
15. Chest, with canvas boat.
16. Canvas boat, ready for use.
17. Model of schooner *Grampus*.

CHRESTEN NELSON, 307 Main street, Gloucester, Mass.:

1. Patent preservative for canvas, manila rope, and netting.
2. Specimens of canvas, rope, and netting preserved with the fluid.

WILLIAM F. NYE, New Bedford, Mass.:

Collection of oils—

1. Fine grades of porpoise and black-fish oils for lubricating watches, machinery, etc.
2. Whale oil, sperm oil, etc.

WILLIAM PALMER, United States National Museum, Washington, D. C.:

1. Casts of cetacea.
2. Casts of fishes.

EBEN PIERCE, New Bedford, Mass.:

Series of whaling implements, including new type of whaling gun.

EDWARD PITCHER, Brooklyn, N. Y.:

Exhibit of spear fishhooks, squids, wire snells, swivels, and swivel sinkers—

1. Pitcher's swivel blue-fish squids.
2. Pitcher's plain blue-fish squid.
3. Pitcher's swivel weak-fish squids, single hooks.
4. Pitcher's swivel weak-fish squid, double hooks.
5. Pitcher's swivel weak-fish squid, treble hooks.
6. Blue-fish pearls on trolls.
7. Jointed tined piano-wire snells.
8. Pearl weak-fish squids, fish shape.
9. Pearl weak-fish squid, profile.
10. Snapper blue-fish trolls.
11. Pitcher's treble swivels.
12. Pitcher's adjustable treble swivels.
13. Pitcher's swivel bass-casting sinkers.
14. Pitcher's swivel sinkers.
15. Columbian swivel pearl trolls.
16. Piano-wire snap pearl trolls with treble hooks.
17. Curio.
18. Spear fishhooks.

THE PRESERVALINE MANUFACTURING COMPANY, 12 Cedar street, New York, N. Y.:

Samples of preservaline, and fish treated with it, as follows:

1. Preservaline for fresh fish, smoked fish, and frozen fish.
2. Preservaline for pickled fish.
3. Preservaline for dry salted fish.
4. Preservaline for shrimp.
5. Preservaline for oysters, lobsters, etc.
6. Shredded cod treated with preservaline.
7. Brick (boneless) cod.
8. Whole cod.
9. Smoked finnan haddie.
10. Shrimp put up in preservaline.

W. DE C. RAVENEL, United States Fish Commission, Washington, D. C.:

Publications on fish-culture, etc.—

1. Report of operations at St. Jerome station for 1884. United States Fish Commission Report for 1884, XII. 1886.
2. Report of operations at St. Jerome oyster-breeding station during 1885. United States Fish Commission Report, 1885, XIII. 1887.

W. De C. RAVENEL, United States Fish Commission, Washington, D. C.—Continued.

Publications on fish-culture, etc.—Continued.

3. Report of operations at the shad-hatching station on Battery Island, Havre de Grace, Md., during the season of 1887. United States Fish Commission Bulletin, VII, for 1887. 1887.
4. Information bearing upon the artificial propagation of mullet. Bulletin, VII, for 1887. 1889.
5. Report of operations at Battery station, Havre de Grace, Md., for the year ending December 31, 1886. United States Fish Commission Report for 1886, XIV. 1889.
6. Report of operations at St. Jerome oyster-breeding station for the year 1886. United States Fish Commission Report for 1886, XIV. 1889.

EDMOND REDMOND, 112 Spencer street, Rochester, N. Y.:

Copper cast of perch—a new process of making fish casts from copper.

RUSSIA CEMENT COMPANY, Gloucester, Mass.:

1. Fish skins used in the manufacture of liquid fish glue.
2. Collection of various kinds of fish glue from the raw, unrefined liquid through the several stages to heavy, refined glue.
3. Fertilizer resulting from the manufacture of fish glue.
4. Collection of various objects showing the utilization of fish glue in the arts and industries.

A. F. RICH, 13 T Wharf, Boston, Mass.:

Photograph of the steel steamer *New England*, for bank fishing.

JOSEPH H. ROWE & CO., Gloucester, Mass.:

Collection of oil clothing.

A. ZENO SHINDLER, United States National Museum, Washington, D. C.:

Paintings of the great auk, *Plautus impennis*, and Funk Island—

1. The great auk, one-third life size, water color.
2. Funk Island, distant about 1½ miles, in oil.
3. Funk Island, distant about 5 miles, in oil.
4. Head of Indian Gulch, eastern end of island, in oil.
5. Grave on Funk Island, in oil.

NOTE.—The great auk has been extinct for about sixty years. It was formerly abundant on Funk Island, off the east coast of Newfoundland. An expedition, under command of Capt. J. W. Collins, collected large quantities of its remains in 1887. The paintings of Funk Island are from sketches made by Captain Collins.

SCIENTIFIC PUBLISHING COMPANY, New York, N. Y.:

Publications on Gems and Precious Stones of North America including chapter on pearls.

G. M. SKINNER, Clayton, N. Y.:

Collection of fluted trolling spoons:

1. Nos. 1 to 8, inclusive, treble hooks.
2. Nos. 1 to 4, inclusive, single hook fly.
3. Nos. 1 and 2, casting single hook.
4. No. 2, casting auxiliary single hook.
5. No. 4¾, combination.

HUGH M. SMITH, United States Fish Commission, Washington, D. C.:

1. Publications on the fish and fisheries of the United States.
   1. Notes on two hitherto unrecognized species of American whitefishes.
   2. The fishes found in the vicinity of Woods Hole.
   3. Notes on fishes from the Lower Potomac River.
   4. Report on a collection of fishes from Albemarle region of North Carolina.

HUGH M. SMITH, United States Fish Commission, Washington, D. C.—Continued.

1. Publications on the fish and fisheries of the United States—Continued.
   5. A review of the history and results of the attempts to acclimatize fish and other water animals in the Pacific States.
   6. The fyke nets and fyke-net fisheries of the United States, with notes on the fyke nets of other countries.
   7. Notes on an investigation of the menhaden fishery in 1894, with special reference to the food fishes taken.
   8. The giant scallop fishery of Maine.
   9. Notes on the capture of the Atlantic salmon at sea and in the coast waters of the Eastern States.
   10. Notes on the king-crab fishery of Delaware Bay.
   11. The salmon fishery of Penobscot Bay and River in 1895 and 1896.
   12. Notes on an improved form of oyster tongs.
   13. Economic and natural history notes on the fishes of the northern coast of New Jersey.
   14. Notes on the crab fishery of Crisfield, Md.
   15. Remarks on the maintenance and improvement of the American fisheries.
   16. The fisheries of Japan (compiled).
   17. Report on the fisheries of Lake Ontario.
   18. Notes on a reconnoissance of the fisheries of the Pacific coast of the United States in 1894.
   19. Statistics of the fisheries of the United States.
   20. Report on the fisheries of the South Atlantic States.
   21. A statistical report on the fisheries of the Middle Atlantic States.
2. Collection of sheepswool sponges, *Hippospongia equina gossypina*, grown from clippings, in water 4 feet deep, near Key West, Fla., 1897–98.

   Two small clippings that had been planted a few weeks.

   One small sponge about 4 months old.

   Five sponges between 8 and 10 months old.
3. One drop-fyke net, from Delaware River.
4. Collection of fresh-water pearl-bearing mussels, *Unionidæ*, of the United States, and their utilization in the manufacture of buttons.

   Specimens of fresh-water mussels:

   Unio rectus, Mississippi River. (Salmon-colored nacre.)

   Unio rectus, Mississippi River. (Purple nacre.)

   Unio crassidens, Mississippi River. (Salmon-colored nacre.)

   Unio crassidens, Mississippi River. (Purple nacre.)

   Unio anodontoides, Cedar River, Iowa; Mississippi River.

   Unio plicatus, Cedar River, Iowa.

   Unio ligamentinus, Rock River, Iowa River, Mississippi River, Skunk River, Iowa.

   Unio capax Wapsie River, Iowa.

   Unio laxissimus, Mississippi River. (Pinkish nacre.)

   Unio tuberculatus, Cedar River, Skunk River, Rock River, Iowa.

   Unio alatus, Mississippi River. (Purple nacre.)

   Unio fallaciosus, male and female, ponds and lakes, Iowa; Mississippi River.

   Unio ventricosus, "Pocketbook clam," Mississippi River.

   Unio multiplicatus, Iowa River, ponds and lakes, Iowa.

   Unio undulatus, Des Moines River, Iowa.

   Unio ebenus, Mississippi River.

   Margaritana rugosa, Mississippi River; Skunk River, Iowa.

   Margaritana confragosa, ponds and lakes, Iowa.

   Anodonta grandis, Des Moines River, Iowa.

HUGH M. SMITH, United States Fish Commission, Washington, D. C.—Continued.

Fresh-water mussels (*Unio anodontoides*) from Cedar River, Iowa, locally called "yellow sun shells," used in manufacture of buttons, as shown in the series exhibited.

Fresh-water mussels (*Unio anodontoides*), with serviceable portions cut out by drills for use in making buttons.

Fresh-water pearl buttons in process of manufacture:

1. Rough blanks.
2. Ground blanks.
3. Rough turned buttons.
4. Drilled and beveled buttons.
5. Polished buttons ready for sewing on cards.
6. Finished buttons on cards, ready for market (2 cards).
7. Additional samples of finished buttons (3 cards).

Shells of fresh-water mussel (*Unio ebenus*) from Mississippi River, showing portions cut out for manufacture into buttons.

4. Crayfish trap, Milwaukee, Wis.

LEONARD STEJNEGER, United States National Museum, Washington, D. C.:

Publications on the fur-seal, *Callorhinus ursinus*, etc.

E. STERLING, Cleveland, Ohio:

Patent fish spears.

TIFFANY & CO., New York, N. Y.:

1. Collection of leather of alligators, lizards, etc.
2. Shagreen made from shark skins, etc.
3. Articles made from skins of alligator, lizard, shagreen, etc.
4. Collection of pearls.

CHARLES H. TOWNSEND, United States Fish Commission, Washington, D. C.:

1. Publications on the fur-seal, *Callorhinus ursinus*, etc.
2. Portfolio of photographs of the fur-seal rookeries on the Pribilof Islands, showing the condition of seal life thereon in 1895, and method of killing seals.

Illustrations showing condition of fur-seal rookeries in 1895 and method of killing seals.

1. Northeast Point rookery, St. Paul Island, July 24, 1895, station 1.
2. Northeast Point rookery, St. Paul Island, July 24, 1895, station 2, north.
3. Northeast Point rookery, St. Paul Island, July 24, 1895, station 2, south.
4. Northeast Point rookery, St. Paul Island, July 24, 1895, station 3.
5. Northeast Point rookery, St. Paul Island, July 24, 1895, station 4.
6. Northeast Point rookery, St. Paul Island, July 24, 1895, station 5.
7. Northeast Point rookery, St. Paul Island, July 24, 1895, station 6.
8. Northeast Point rookery, St. Paul Island, July 24, 1895, station 25.
9. Polavina rookery, St. Paul Island, July 26, 1895, station 21.
10. Polavina rookery, St. Paul Island, July 26, 1895, station G.
11. Lukannon rookery, St. Paul Island, July 20, 1895, station 12.
12. Lukannon rookery, St. Paul Island, July 20, 1895, station 26.
13. Ketavie rookery, St. Paul Island, July 20, 1895, station 13.
14. Ketavie rookery, St. Paul Island, July 20, 1895, station 14.
15. Ketavie rookery, St. Paul Island, July 20, 1895, station 14½.
16. Ketavie rookery, St. Paul Island, July 20, 1895, station 15.
17. Reef rookery, St. Paul Island, July 20, 1895, station 16.
18. Reef rookery, St. Paul Island, July 20, 1895, station 17.
19. Reef rookery, St. Paul Island, July 20, 1895, station 18.
20. Reef rookery, St. Paul Island, July 20, 1895, station 19.

CHARLES H. TOWNSEND, United States Fish Commission, Washington, D. C. -Con'td.
Illustrations showing conditions of fur-seal rookeries, etc.—Continued.

21. Reef rookery, St. Paul Island, July 20, 1895, station 20.
22. Reef rookery, St. Paul Island, August 5, 1895, near station 17; grass area showing growth of grass upon ground almost bare in 1892.
23. Reef rookery, St. Paul Island, "grass area," showing condition in July, 1892.
    (To be compared with same view for 1895.)
24. Lagoon rookery, St. Paul Island, July 11, 1895, station 27.
25. Tolstoi rookery, St. Paul Island, July 24, 1895, station 11.
26. Tolstoi rookery, St. Paul Island, July 24, 1895, station F.
27. Lower Zapadnie rookery, St. Paul Island, July 20, 1895, station 7.
28. Lower Zapadnie rookery, St. Paul Island, July 20, 1895, station 7*a*.
29. Lower Zapadnie rookery, St. Paul Island, July 20, 1895, station 8*a*.
30. Upper Zapadnie rookery, St. Paul Island, July 20, 1895, station 8.
31. Upper Zapadnie rookery, St. Paul Island, July 20, 1895, station 9.
32. Upper Zapadnie rookery, St. Paul Island, July 20, 1895, station 10.
33. East rookery, St. Paul Island, July 18, 1895, station 9.
34. Little East rookery, St. George Island, July 18, 1895, station B.
35. North rookery, St. George Island, July 18, 1895, station 1.
36. North rookery, St. George Island, July 18, 1895, station 2.
37. North rookery, St. George Island, July 18, 1895, station 5.
38. Starry Arteel rookery, St. George Island, July 18, 1895, station E.
39. Zapadnie rookery, St. Paul Island, July 19, 1895, station D.
40. Zapadnie rookery, St. George Island, July 19, 1895, station H.
41. A drive of seals from Reef rookery, St. Paul Island, July, 1895.
    Killing, skinning, cutting meat for food; rejected seals going back to beach.
42. Seal killing, St. Paul Island, July, 1895.
    Clubbing and driving off rejected seals.
43. Seal killing, St. Paul Island, July, 1895.
    "Sticking" seals just clubbed; rejected seals returning to beach.
44. Seal killing, St. Paul Island, July, 1895.
    A "pod" just knocked down.
45. Seal killing, St. Paul Island, July, 1895. Skinning gang at work.
46. Seal killing, St. Paul Island, July, 1895. Skins removed; food meat being cut from carcasses.

HYDROGRAPHIC OFFICE, Bureau of Navigation, United States Department of the Navy:
Charts of Atlantic and Pacific coasts and of the North Atlantic Ocean.

UNITED STATES COAST AND GEODETIC SURVEY, Henry S. Pritchett, Superintendent, Department of the Treasury:
Collection of charts of Atlantic and Pacific coasts of North America.

L. WILZINSKI, 1057 North Halsted street, Chicago, Ill.:
Collection of dried sturgeon sounds (isinglass) from fish taken in various sections of the United States.

J. & W. R. WING, New Bedford, Mass.:

1. Cutting spade used in whale fishery.
2. Mounted hand harpoon (toggle iron).
3. Mounted hand lance.
4. Slab of baleen or whalebone from Bowhead whale (*Balæna mysticetus*), taken in Arctic Ocean.

YAWMAN & ERBE, Rochester, N. Y.:
Automatic reel.

CONCORDANCE TO THE OFFICIAL CLASSIFICATION FOR THE USE OF THE JURIES.

NOTE.

In the collective exhibit of the United States are included many articles which are labeled with the names of the persons from whom they were obtained. These are not, as a rule, entered for competition.

In the following list are included the names of all exhibitors who will be permitted to receive awards or special mention from the juries.

The artists and preparators by whom the pictures, photographs, casts, stuffed specimens, lay models, etc., have been prepared may be classed as exhibitors. A list of their names is given at the beginning of this catalogue.

Group I.—FISH PRODUCTS.

Class 1. Fish, fresh, iced or frozen, lobsters, oysters, mussels, etc.
The Preservaline Manufacturing Company, New York, N. Y.

Class 2. Fish, salted, dried, smoked, or cured in similar manner.
United States Commission of Fish and Fisheries. Collective exhibit. Groups 90, 91, and 92.
Max Ams, New York, N. Y.
J. W. Beardsley's Sons, New York, N. Y.
John R. Neal & Co., Boston, Mass.
William H. Wonson & Son, Gloucester, Mass.

Class 3. Fish, tinned, or preserved in similar manner.
United States Commission of Fish and Fisheries. Collective exhibit. Groups 93, 94, and 95.
Max Ams, New York, N. Y.
John R. Neal & Co., Boston, Mass.
The Preservaline Manufacturing Company, New York, N. Y.

Class 4. By-products, as oil, roe, stearin, glue, feeding stuffs, guano, etc.
United States Commission of Fish and Fisheries. Collective exhibit. Groups 96, 97, 98, 99, 100, 101, 102, 103, and 104.
Max Ams, New York, N. Y.
Mary A. Gardner, Miami, Fla.
William F. Nye, New Bedford, Mass.
Russia Cement Company, Gloucester, Mass.
Hugh M. Smith, Washington, D. C.
Tiffany & Co., New York, N. Y.
L. Wilzinski, Chicago, Ill.
J. & W. R. Wing, New Bedford, Mass.

Group II.—FISHING APPARATUS.

Class 1. Twine of hemp, flax, cotton, silk, and other material; seines and nets, in netting as well as complete, also models.
United States Commission of Fish and Fisheries. Collective exhibit. Groups 48, 49, 50, 51, 52, and 53.
G. B. Borden, Acushnet, Mass.
The W. J. Hooper Manufacturing Company, Baltimore, Md.
H. & G. W. Lord, Boston, Mass.

Group II.—FISHING APPARATUS—Continued.

Class 2. Apparatus for the angle fishing, including long lines, hand lines, leaders, fishhooks, floats, buoys, cork, and artificial bait for the sea fishery.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 27, 28, 29, 30, 31, 32, 33, and 34.

L. D. Lothrop, Gloucester, Mass.

B. C. Milam & Son, Frankfort, Ky.

Edward Pitcher, Brooklyn, N. Y.

E. Sterling, Cleveland, Ohio.

Class 3. All kinds of natural bait and methods of its application.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 4, 5, 8, 9, 10, 12, 13, 15, 18, 20, and 23.

Class 4. Apparatus for the whale, bottle nose, and seal catch, and trawling. All kinds of fish pots, eel spears, and representations of other methods of catching.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 26, 27, 52, 53, 54, 58, 59, 75, 76, 77, 78, 79, 80, 81, 82, and 83.

F. E. Brown, New Bedford, Mass.

Paul E. Collins, Boston, Mass.

The W. J. Hooper Manufacturing Company, Baltimore, Md.

Charles B. Hudson, Washington, D. C.

L. D. Lothrop, Gloucester, Mass.

Eben Pierce, New Bedford, Mass.

Hugh M. Smith, Washington, D. C.

J. & W. R. Wing, New Bedford, Mass.

Group III.—VESSELS EMPLOYED IN THE CATCH, AND THEIR EQUIPMENT.

Class 1. Fishing vessels, fishing boats, with models and drawings of same.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 60, 61, 62, 63, and 64.

Charles B. Hudson, Washington, D. C.

Lawrence Jensen, Gloucester, Mass.

C. R. Luscombe, Washington, D. C.

Thomas F. McManus, Boston, Mass.

A. F. Rich, Boston, Mass.

Class 2. Seine, net, and line winches, windlasses, anchors, and grapnels with cables.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 45, 65, 66, 67, and 68.

L. D. Lothrop, Gloucester, Mass.

Class 3. Compasses, spy-glasses, barometers, signal apparatus, wave-subduers, life belts, drag-sails, stoves, etc.

Joseph H. Rowe & Co., Gloucester, Mass.

United States Commission of Fish and Fisheries. Collective exhibit. Group 67.

Hydrographic Office, Bureau of Navigation, United States Department of the Navy.

United States Coast and Geodetic Survey, Henry S. Pritchett, Superintendent, Department of the Treasury.

Class 4. Canvas, prepared and unprepared; cordage, blocks, tarpaulins.

Chresten Nelson, Gloucester, Mass.

Group IV.—PRESERVATIVES.

Class 1. Salt, boracic acid, ice, and other material for the preservation of fish.

The Preservaline Manufacturing Company, New York, N. Y.

Group IV.—PRESERVATIVES—Continued.

Class 2. Bark, catechu, oil, paint, tar, compositions for coating ships' bottoms, canvas preservatives, and other materials for the preservation of apparatus.

Chresten Nelson, Gloucester, Mass.

Group V. LODGING SHIPS, LODGING HOUSES, AND STATION HUTS AND THEIR INTERIOR ARRANGEMENTS. MODELS AND DRAWINGS OF SAME.

United States Commission of Fish and Fisheries. Collective exhibit. Group 72.

Group VI.—TANK AND OTHER TRANSPORT VESSELS.

Wells, transportation wagons, cases, or other transportation of fish. Models or drawings of same.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 84, 85, and 88.

Group VII.

Class 1. Models and drawings of warehouses, salting establishments, smoke-houses, ice houses, and other cold rooms.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 86, 88, and 89.

Class 2. All kinds of apparatus necessary for the preservation of fish, including barrels, staves, and hoops, fish cases and cans, and also machines used in the manufacture and soldering of same.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 85, 86, and 87.

Max Ams, New York, N. Y.

L. D. Lothrop, Gloucester, Mass.

Group VIII.—MACHINES, TOOLS, AND APPARATUS.

Class 1. Machines and tools used in the manufacture of fishing tackle or parts of same, including knives, cooper's tools, ice crushers, etc.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 55, 56, and 57.

L. D. Lothrop, Gloucester, Mass.

Class 2. Apparatus for the manufacture and improving of the by-products of the fisheries. All kinds of oil, glue, feeding stuffs, guano, etc.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 56, 57, 82, and 86.

Russian Cement Co., Gloucester, Mass.

Group IX.—FISH CULTURE.

Class 1. Apparatus for hatching fish, oysters, mussels, with models and drawings of fish ladders, etc.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 110, 111, 112, 113, and 114.

Class 2. Collections illustrative of hatching, development, and growth of fry, either alive or in alcohol, or otherwise.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 105, 106, 107, 108, 109, 115, 116, and 117.

Group X.—PLEASURE FISHERIES.

All apparatus pertaining to this category, as fishing rods with gear, nets, long lines, hand lines, artificial bait, etc.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 30, 31, 32, 33, 34, 35, 36, 37, 44, 45, 49, and 69.

Calvin W. Graves, Natural Bridge, N. Y.

Monroe A. Green, Rochester, N. Y.

The Horton Manufacturing Company, Bristol, Conn.

B. C. Milam, Frankfort, Ky.

Edward Pitcher, Brooklyn, N. Y.

G. M. Skinner, Clayton, N. Y.

Yawman & Erbe, Rochester, N. Y.

Group XI.—FACTS ABOUT THE FISHERIES AND THEIR DEVELOPMENT.

Class 2. Scientific collections, pictorial representations, casts of fishes, stuffed fishes, birds, and other marine animals and plants of importance to the fisheries.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, and 23.

A. H. Baldwin, Washington, D. C.

Henry W. Elliott, Cleveland, Ohio.

Sherman F. Denton, Wellesley, Mass.

George Marshall, Laurel, Md.

Enterprise Manufacturing Company, Philadelphia, Pa.

George H. H. Moore, Washington, D. C.

William Palmer, Washington, D. C.

Memorial Museum, Golden Gate Park, San Francisco, Cal.

A. Zeno Shindler, Washington, D. C.

Charles H. Townsend, Washington, D. C.

Class 4. Books, charts, periodicals, and drawings of importance to the fisheries.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 105, 119, 120, and 121.

Marcus Benjamin, Washington, D. C.

Paul E. Collins, Boston, Mass.

Henry W. Elliott, Cleveland, Ohio.

Barton Warren Everman, Washington, D. C.

Charles B. Hudson, Washington, D. C.

George E. Jennings, New York, N. Y.

David S. Jordan, Leland Stanford Jr. University, Stanford University, Cal.

W. de C. Ravenel, Washington, D. C.

T. W. Smillie, Washington, D. C.

Hugh M. Smith, Washington, D. C.

Leonard Stejneger, Washington, D. C.

Charles H. Townsend, Washington, D. C.

Hydrographic Office, Bureau of Navigation, United States Department of the Navy.

United States Coast and Geodetic Survey, Henry S. Pritchett, Superintendent, Department of the Treasury.

S. G. Worth, Washington, D. C.

Group XI.—FACTS ABOUT THE FISHERIES AND THEIR DEVELOPMENT—Continued.

Class 5. Publications bearing upon the politico-economical importance of the fisheries. Statistics.

United States Commission of Fish and Fisheries. Collective exhibit. Group 121.

W. H. Benton, Washington, D. C.
F. F. Dimick, Boston, Mass.
Henry W. Elliott, Cleveland, Ohio.
David S. Jordan, Stanford University, Cal.
George Frederic Kunz, New York, N. Y.
Leonard Stejneger, Washington, D. C.
Scientific Publishing Company, New York, N. Y.
Hugh M. Smith, Washington, D. C.
Charles H. Townsend, Washington, D. C.

Class 6. Facts about relief funds and loan offices for fishermen and other particulars about the economy of the fishing population.

United States Commission of Fish and Fisheries. Collective exhibit. Groups 69, 70, 71, 72, 73, and 74.

PART II.

REPORT UPON THE BERGEN EXHIBITION AND THE FISHERIES COLLECTIONS EXHIBITED BY OTHER COUNTRIES.

REPORT

UPON THE

BERGEN EXHIBITION AND THE FISHERIES COLLECTIONS EXHIBITED BY OTHER COUNTRIES.

INTRODUCTION.

A report upon the fisheries of other countries, particularly those of Europe, must obviously contain much information which may prove advantageous to the fishery industries of the United States. This may be conceded, even if it is true that our fisheries hold an advanced position in many particulars, and especially so far as apparatus, methods of capture, and preparation of products are concerned. For it is wiser to avail ourselves of all obtainable knowledge, however simple it may appear, since it is sometimes difficult to say exactly what class of information may lead to important, and perhaps unexpected results in the profitable utilization of our natural resources.

Our fisheries are so varied and extend over such an immense area, even in littoral waters, reaching from the tropical regions to the arctic, that a published account of some method of fishing, or of curing, or a description of certain forms of apparatus may contain hints or suggestions of value to fishermen and curers, even if the things described may seem to a cursory observer to have little real merit in them.

This view of the subject has impressed me most forcibly, and for this reason I have ventured to discuss the exhibits of other countries as I found them. It has seemed to me inadvisable to refer only to so-called improvements, which, though given prominence, have not been allowed to monopolize attention. For it is quite possible that the simplest and most common-place things may be most useful under certain conditions of environment, where the proper utilization of available material is perhaps the most potent question that may confront the fishermen, and the determination of this question decides whether fishing can be successfully prosecuted or not.

Other things, however, are so obviously meritorious that uncertainty as to the advisability of their adoption by Americans is largely, if not entirely, eliminated.

While, therefore, it has been manifestly impracticable to monograph the exhibits of other countries, an effort has been made to present the salient features of them in as clear and efficient a manner as the limitations of this report will permit. In all cases conciseness has been considered, particularly when illustrations have aided in making a proper presentation of the subject under consideration.

In many cases, however, detailed discussion has been unavoidable, largely because no similar report on an international fisheries exhibition has heretofore been published by the United States Government, and also because inexact or indefinite treatment of technical subjects would prove misleading and unsatisfactory. The main object in view has been to consider most fully those subjects which are believed to offer suggestions of greatest value to people interested in American fisheries.

The gathering of the data upon which this report is based was a task of no small magnitude. It demanded the closest attention and most exacting labor on the part of the writer during the comparatively brief time available for the work.[1]

Translations were made chiefly by Mr. Kahrs and Mrs. Ennersen, although Mr. Johnson aided some in this work. Mr. Abbott made many drawings,[2] and a large number of photographs were made by Mr. Wentz, under the personal supervision of the writer. It was not, however, permissible to take photographs inside the grounds, consequently the illustrative material for the exhibition buildings, etc., had to be obtained elsewhere.

The obtainment of an extensive collection of photographs and drawings was deemed very important, for technical descriptions unaided by suitable illustrations may prove of little or no value because of the difficulty people unfamiliar with the subjects may have in understanding them clearly. This is especially true when, as in the present instance, the necessities of the case compel the prompt completion of the report quite regardless of any other consideration—a condition that makes impossible more exhaustive treatment of the subjects under consideration.

The extreme courtesy of the foreign commissioners, the exhibition authorities, and many of the Norwegian exhibitors made possible the procurement of a rich and varied assortment of illustrations.

[1] The early part of the exhibition period was occupied in completing the installation. This was followed by duties in connection with making the awards, which continued until late in August. Thus only a little more than a month remained in which to secure illustrative material and to collect notes needed for the report.

[2] These were mostly made with pencil or roughly with ink. Subsequently they, as well as drawings by the writer, were redrawn by Mr. Abbott, or by others assigned by United States Commissioner George M. Bowers to assist in the work. Mr. Abbott also retouched many of the photographs to make them suitable to be engraved. The private collections of the writer have also been drawn upon to some extent to illustrate this report.

MAIN EXHIBITION BUILDING.

Photographed by Nyblin.

Special acknowledgments are due to Dr. Von Grimm, commissioner from Russia, and his assistants, Messrs. Von Hulsen and Von Kuhne, for uniform kindness and courtesy in affording me every facility to obtain photographs and drawings of Russian exhibits, and also for making translations of great value. Like acknowledgments are due Mr. Sandman, commissioner from Finland; Dr. Rudolph Lundberg, commissioner from Sweden; Mr. Feddersen, commissioner from Denmark; M. Pérard, commissioner from France, and Dr. Kishinouye, commissioner from Japan. Without exception these gentlemen and their assistants did all in their power to make possible the proper illustration of the objects exhibited by their respective countries.

The writer is also under obligations to Capt. G. Sorensen, who was in charge of the Norwegian fisheries exhibits, for information, and for aid in securing illustrative material; to Mr. Johan Fleischer, secretary of the Society for the Promotion of Norwegian Fisheries, for many courtesies; to Messrs. Kraasby Bros. & Co., for the privilege of copying their painting of a whaling steamer; to M. Jornsen, for a similar courtesy; to Mr. J. A. Johnsen, for plans of his improved design for a Nordland fishing boat; to Mr. Olaf T. Oisen, for plans of a four-oared boat; to Mr. C. F. Carter, for photographs of the Grimsby fish market and the workshops of the Great Grimsby Coal, Salt, and Tanning Company, Limited; to Mr. O. T. Olsen, of Grimsby, for various courtesies, including information in regard to the British fisheries; and to Messrs. Cochran & Cooper, of Beverly, England, for plans of fishing steamers.

GENERAL FEATURES OF THE EXHIBITION.

The site of the exhibition, the fine public park known as Nygaardsparken, was well chosen, considered from the standpoint of location or fitness. This park has an area of 35 acres, and is situated in the southern part of Bergen, in one of the most fashionable sections of the city. It has a broad water front on the Puddefjord, where boats may lie, and a salt-water pond or lagoon for marine mammals and sea birds. On the border of this pond is located the Bergen marine biological laboratory, with its aquarium, which easily became a most interesting part of the exhibition.

The section of the park near the water is low and rather flat, and this furnished satisfactory sites for many of the principal exhibition buildings, including the main building, which stood on the edge of a salt-water lagoon that afforded accommodation for a fleet of fishing boats moored there. Back of this the park is diversified in contour, rising gradually in some places, but more abruptly elsewhere; and the winding or zigzag roads, fringed by shrubbery or green lawns, are adapted to the natural terrace-like arrangement of the elevations. The existing fountains, trees, shrubbery, and flowers combined to lend their charm to the landscape, thus making the effect exceptionally pleasing; the

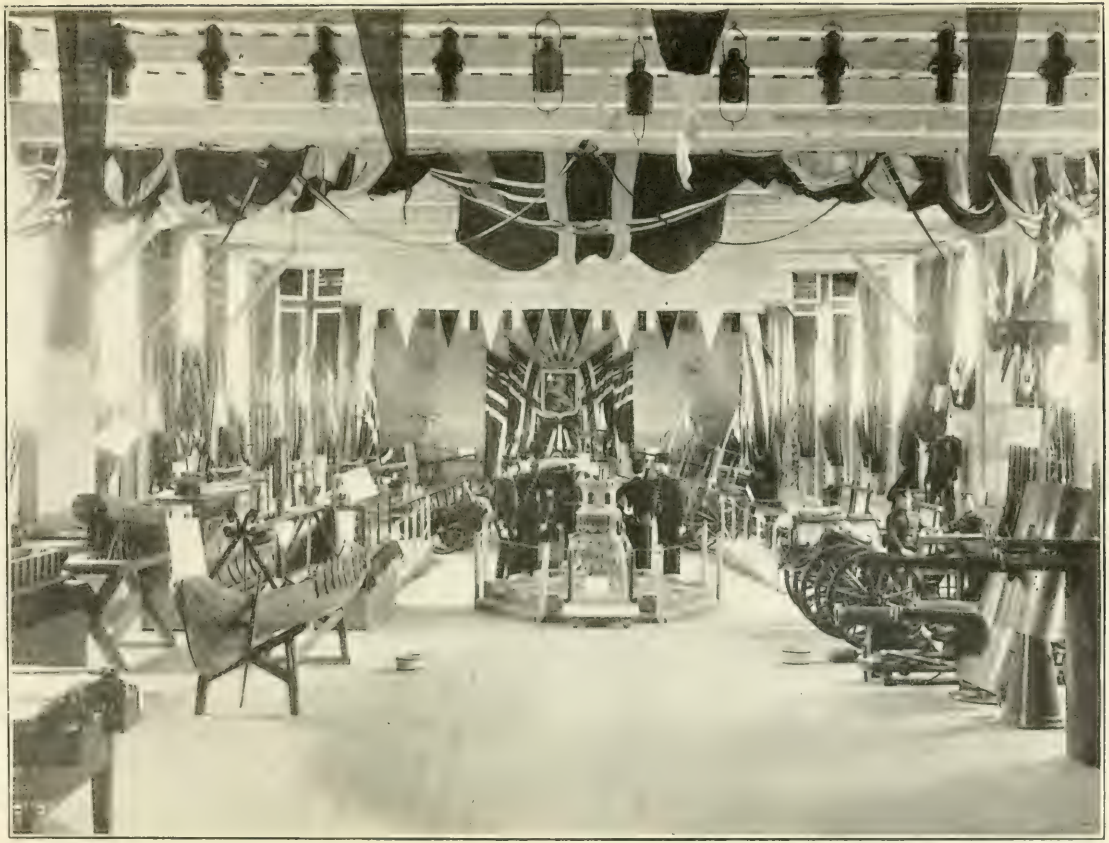
more so, perhaps, because fortunately it was not necessary to subordinate the natural beauties of the park to the needs of the exhibition.

The main building (Pl. X), because of its size and Norse characteristics, may, perhaps, be considered the most noticeable architectural feature of the exhibition, particularly if only those structures are considered which were devoted to exhibition purposes. As a rule, the buildings in which the exhibits were installed were quite devoid of architectural beauty, since they were mostly plain, roughly constructed, shed-like wooden structures temporarily erected for the occasion, or existing storehouses which were adapted to the needs of the exhibition, but in some cases at least they were improved in appearance by external additions or modifications. The accompanying illustrations indicate their general appearance.

FIG. 2.—Fine arts building. (Photographed by Nyblin.)

As already indicated, these buildings were mostly located near the fjord. The only exception, so far as the general exhibition buildings are concerned, was the fine arts building (fig. 2), which stood on the road leading from the main entrance to the principal restaurant, the "Hovedrestaurant." This was a low, plain, unpretentious stucco edifice, well adapted to its purpose so far as the interior and arrangement of light were concerned, but without any specially attractive feature exteriorly, though it must be confessed its neat, modest appearance impressed one favorably.

As a specimen of ancient Scandinavian architecture, which it was



NORWEGIAN ARMY AND NAVY EXHIBIT.

Photographed by Nyblin

intended to reproduce, the building (fig. 3) erected by the city of Christiania deserves mention. The plain exterior, gables, pitched roofs, square, pointed bell tower and antique-looking windows with small panes, gave the structure a notable and very interesting appearance, even though it differed radically from prevailing architectural forms of the present day.

FIG. 3.—Christiania building. (Photographed by Nyblin.)

Among the restaurants, booths, and small structures for exhibition purposes were some rather interesting examples of the architect's skill. These included the "Hovedrestaurant," Kropelin's pavilion, Friele's coffee pavilion, Digre's yacht pavilion, and the building of the Christiania butter manufactory—"Christiania smörfabrik."

FIG. 4.—Main restaurant. (Photographed by Nyblin.)

The first of these (fig. 4) was built on the side of a steeply terraced hill, facing the main exhibition building, and the combination of open arches, balconies, and gables on the front had a pleasing effect and

harmonized with the surroundings, while attaining the maximum of utility. Kropelin's pavilion (fig. 5), in imitation of a Swiss chalet, was light and pretty, and its colors contrasted effectively with the bright green of the sloping hillside upon which it stood and the foliage in its immediate vicinity.

FIG. 5.—Kropelin's pavilion. (Photographed by Nyblin.)

Friele's pavilion (fig. 6), of Moorish design, and intended to represent a Tunisian café, seemed unique and strangely at variance with the structures around it.

FIG. 6.—Friele's pavilion. (Photographed by Nyblin.)

NORWEGIAN EXHIBIT, UNDER THE DOME IN MAIN BUILDING.

Photographed by Nyblin

International Fisheries Exhibition, which embraced exhibits of fish and fisheries from Norway and various other countries.

Under this arrangement it was apparently intended to exclude from the first division all foreign materials, or manufactures, as well as objects pertaining to fisheries, while all the latter were supposedly inclusive under the international section, which, however, was not expected to embrace material except such as was directly associated with the fisheries. This was the general purpose of the exhibition programme.

It must be conceded, notwithstanding, that the classification was rather indefinite in some particulars, and it developed, in connection with the jury work, that there had been more or less misunderstanding of its provisions, due in part, it was claimed, to differences between the English version and those in other languages. It is not deemed necessary for the purposes of this report to do more than make a passing allusion to this matter, chiefly for the purpose of leading to a better understanding of certain conditions hereafter to be mentioned.

INDUSTRIAL EXHIBITION.

General definition.—That part of the exhibition coming under the official designation of "Haandværks and Industriafdelingen," was, as its name indicates, designed to be an exhibition of national handiwork and industrial development. It is not my object, however, to discuss this section in detail, but simply to refer to its most salient features, in order that some idea may be conveyed of its scope and its relations to the international, or fisheries section of the exhibition, with which this report chiefly deals.

Extent and location of exhibits.—The magnitude of the national industrial collections was far in excess of the international exhibits, and the most conservative estimate would indicate that the former occupied fully six or seven times the space assigned to the fisheries.

In the main building the industrial exhibits filled two of three wings, the central space under the dome, and the galleries. Besides, large buildings were filled with the naval collections, the school exhibits, machinery, agricultural implements, horticulture, etc., while smaller structures—usually exhibits in themselves—were scattered over the park in such manner as to appear to the best advantage.

The building containing the naval exhibit and various other collections was one of the largest structures. It was situated between the Puddefjord and the main building, directly opposite the latter, and separated from it by the lagoon heretofore referred to.

The post-office and postal telegraph, illustrating the postal facilities and postal management in Norway, the horticultural building, the machinery hall, the buildings containing exhibits of carriages, stoves, agricultural implements, etc., were northwesterly from the main building, on the low flat area next the fjord.

NORWEGIAN EXHIBIT, SOUTHEASTERN HALL OF MAIN BUILDING

Photographed by Nyblin.

Farther back, on or near the road leading from the main entrance, were the Christiania building, containing collections chiefly illustrating the municipal government of that city—schools, police, fire protection, architecture, etc.—the fine arts building; an elevator or lift arranged in an open tower, from the top of which a bird's-eye view of the park, city and harbor could be obtained; and certain small structures of brick, paper, etc. Elsewhere were exhibits of structural objects, such as slate, cement, and artificial stone, put up attractively as towers, ornamental stairs, and such other forms as they were well adapted to.

A sæter, with its birch-bark roof, covered with sod and a luxuriant growth of grass and small shrubbery, although somewhat diminutive in size, was an interesting isolated exhibit, since it illustrated a peculiar phase of Norwegian peasant life, which probably is not paralleled elsewhere in the world.

A sæter is usually a small log hut, generally not exceeding 12 or 14 feet in length by 8 or 10 feet in width. In many sections of Norway this is the summer residence, high upon the mountain side, of one or more members of a peasant's family—often girls from 14 to 20 years of age—who care for and milk the herds of goats and cattle which, in early summer, are driven up the mountains, where grazing can be found far above and miles distant from the farms along the fjords. The milk is converted into cheese and butter at the sæter, but sometimes it is sent down on wires strung from the mountain tops to the houses far below; and, after the cans are emptied, they are hauled back to be refilled the next day.

Special features.—If space and other conditions permitted, an extended consideration of the special features of this section of the exhibition might prove interesting as bearing on the general industrial development of Norway; but it seems impracticable to do more than to make a brief allusion to some of these, sufficient only to convey a general idea of the subject-matter.

The naval exhibit embraced materials illustrative of the history and present condition of the Norwegian navy. Models and plans of obsolete types of war vessels and ancient guns were shown beside the representations of modern war ships and ordnance.

The collections afforded an opportunity for an interesting study of the development of war vessels and their equipment, from the ancient viking ship, carrying warriors' shields on its sides for the use of its spearmen when boarding another vessel or when making a foray on land, to the armed and turretted battle ship of the present day, a floating steel fortress, armed with high-power rifled guns, possessing a range and accuracy of fire scarcely short of marvelous. The intermediate steps were found in the round-bowed sailing frigate of a century ago or more; the paddle-wheel steamer of the forties; the

high-sided wooden war ship propelled by a screw; and the monitor, the advent of which led directly to the highly specialized battle ship of recent design.

Associated with the naval display was an army exhibit, which embraced in like manner materials relating to the equipment and operations of an army. Figures of soldiers dressed in the uniforms of the service, small arms of various kinds, field guns, plans or other representations of fortifications, field-hospital equipments, etc., fairly illustrated what had been accomplished in these directions.

The very creditable exhibits of models and plans of ship builders or designers, seen in the main building, emphasized the important strides recently taken by Norway in the shipbuilding industry. There are at least two large shipbuilding companies at Bergen, not to speak of others in Norway, which make a specialty of constructing iron and steel vessels. While it is probable their facilities may not equal those of the mammoth shipbuilding concerns in Great Britain, they nevertheless are doing good work, and, so far as form of hull and excellence of construction are concerned, the Norwegian merchant vessels (not including small coasters) will probably not suffer by comparison with those of any other country. I have never seen superior designs for the purpose for which the ships were required, and, so far as I had opportunity to study the construction of iron and steel vessels, I was most favorably impressed by it.

Having in view the rapid growth of the Norwegian merchant marine, the low cost of labor, the notable aptitude of the people for maritime affairs, and the natural advantages for building, such as deep harbors, etc., the development in this special industry, as shown by the exhibits, may fairly be taken as indicating larger growths in the near future.

There were many exhibits of furniture, not a few of which were worthy of special mention. Some of the native woods lend themselves readily to the manufacture of household furniture, and even in conventional forms are so well prepared that they show considerable skill and art in manufacture.

A very prominent feature in this field of Norwegian industry is, however, the tendency to reproduce, in more or less idealized forms, the peculiar ornamentation in favor among the ancient Norsemen; and it must be confessed that the carvings, when well executed, are far from commonplace, and often possess a charm and a fitness entirely their own. In the eager search for novelties in furniture American manufacturers may possibly find it advantageous to adopt some of these Norwegian designs, even though it may be conceded that the historical or traditional associations that connect them with the past in Norway may often have stronger influence on the buyer than the beauty or utility of the article itself.

The displays of Norwegian jewelry, silverware, and enameled

SOUTH HALL OF MAIN BUILDING

Photographed by Nyblin.

goods were rich, comprehensive, and for the most part strictly characteristic of the domestic manufacture. While it is true that conventionality was observable in some things, the enameled ware and articles of silver included many original Norse designs which are artistic and attractive, even if disassociated with the idea that they are representations of Scandinavian handiwork a feature that enhances their value to some, and especially to people of Scandinavian origin.

The exhibits of structural materials, such as marble and other forms of building stones, were well arranged and very creditable; they embraced many kinds of stone worked into attractive and appropriate designs.

I am informed that this branch of Norwegian industry is largely of recent development, particularly so far as the quarrying of marble is concerned. Slate is easily obtained and is widely utilized. It seems probable the demand for other building stones may steadily develop as their qualities are better understood.

The improvement in recent years in the manufacture of textile fabrics was well exemplified by numerous exhibits more or less comprehensive. Although the handloom is by no means obsolete in Norway, and homespun is extensively if not universally worn by the peasantry, the fabrics turned out by the woolen mills are of a quality needed to supply the demand for high-grade goods, as well as for cheaper materials, and doubtless will ultimately take the place of the coarser homemade cloth.

A noticeable feature in the manufacture of textiles is found in the production of ancient forms of Norse tapestries, known as *Aakladeer*.[1]

For some years past there has been a growing desire on the part of Norwegians to collect antique tapestries and to use them for decorative purposes in their homes. Naturally the demand for such articles was increased and the price enhanced correspondingly. This led to attempts to copy the old patterns, a not very difficult matter, since the handloom alone is used in their production and the work is simple, though the finished fabric is often quite artistic. These tapestries are generally of rather small size, seldom exceeding 4 or 5 feet in length or breadth, so far as my observation extended, and they more nearly resemble in design the work of the Navaho and Zuni Indians than any other fabrics I have seen. They are exceedingly popular among Norwegians, and the numerous exhibits and large variety of patterns indicated the effort now being made to cater to the national taste. Some of the exhibitors of such goods had handlooms in operation in connection with their exhibits, thus furnishing a practical demonstration of the method of production.

In no other way, perhaps, were the special features of Norwegian

[1] This is pronounced "ǫoklair," while the singular form of the noun, *Aakkaede*, is pronounced "aoklay."

handiwork more strongly demonstrated than in the numerous and varied presentations of the native embroidery. Some of the finest of this, it is true, was more or less conventional in execution, but the larger part was purely Norwegian. The Hardanger embroidery has long been celebrated for its unique beauty, and the numerous examples of it in the industrial halls attracted well-deserved admiration.

Wood carving and painted woodwork were well represented. Norway has long been famed for its wood carvings, which are largely the product of the province of Hardanger. It would be impracticable to enumerate here the different carved objects made for sale by the peasantry. The most common forms are fancifully carved knives and forks, spoons, mugs, placques, picture frames, viking ships, and drinking horns. These are used almost wholly, if not exclusively, for decorative purposes.

The painted woodwork is unique, and notably a domestic production. The colors are garish, and the effect not always pleasing or harmonious. Nevertheless, this style of ornamentation is in high favor for many varieties of wooden articles. Among these the most noticeable are chests or trunks and hand baskets, the latter often taking the place of a reticule for shopping purposes or marketing. They are also used as work baskets. Wooden shoes and toys, crudely cut out with knives, are decorated in this manner.

The method of decorating wooden objects, by burning with hot irons, is in vogue in Norway, and pyrography undoubtedly competes for popularity with the more characteristically national forms of ornamentation already alluded to. This likewise has a considerable range of application, being adapted to most forms used purely for decorative purposes, as well as those of general utility. Among the articles of this kind on exhibition work baskets, market baskets, and fancy placques took precedence.

The exhibits of leather goods, such as trunks, valises, portfolios, etc., though good, were conventional, and presented no strikingly novel feature.

There were several fine collections of furs, and garments made of fur, on exhibition. They generally embraced not only peltries used for wearing apparel and the completed garments, but also skins for rugs, carriage robes, and other articles.

These exhibits, as a rule, included skins of animals from tropical countries, such as the tiger, for example, but northern peltries predominated. Among the latter were skins of the white bear, foxes of several varieties, the fur seal, hair seals of various species, skunks, martens, sable, mink, beaver, etc.

Some of the collections were installed with much skill and taste. The background of one, for instance, represented a polar scene, with a ship in the distance locked in the ice, and hunters in the foreground

GENERAL VIEW OF FISHERIES EXHIBITS, NORTH HALL OF MAIN BUILDING.

Photographed by Nyblin.

attacking a polar bear. The life-size figures of men and animals, the former equipped with guns, and the accurate representation of ice and ship made up a realistic picture of life in the far north, which was an appropriate accessory to an exhibit of northern furs and fur-bearing animals.

In no part of the industrial exhibition was more artistic skill displayed than in the arrangement of some of the collections coming under the general classification of confectionery, while the quality of the goods of this class was very high. Considered from the standpoints of method of installation and meritorious material, the displays included under this head were not excelled by any commercial exhibits, and it may justly be said that they reflected honor on Norway for the advanced position she has taken in this particular. The life-size figures made of chocolate were examples of artistic installation.

The soap industry was well represented, and also commanded attention for the character of the goods exhibited and the exceptional taste displayed in presenting them to the public.

Among sporting goods the effective arrangement of wooden snow-shoes, locally called ski, was perhaps most conspicuous, since they are especially associated with the national life and sports of Norway.

There was one good exhibit of angling tackle and other accessories of sport fishing. This also included some fine plaster casts of salmon. But the showing in this direction was scarcely what might have been expected in a country exceptionally rich in trout and salmon streams, and without a rival in western Europe in the inducements it is able to offer anglers.

Considering the extent of the exhibition, machinery was well represented, both in variety and amount. Inasmuch, however, as this section was supposed to form a part of the national exhibit of handiwork and industrial achievement, one could scarcely fail being impressed with the large quantity of foreign-made machinery exhibited by selling agents.

Machinery of American manufacture was much in evidence. A large part of the agricultural implements exhibited were manufactured in the United States; indeed there were few others of approved designs.

Besides these, American windmills, sewing machines, etc., were among the most prominent objects in the industrial sections of the exhibition—a fact that emphasizes the adaptability of our mechanical productions and the place they occupy in Europe, despite the keen competition which confronts them.

Nothing in the national collections of Norway was more strikingly characteristic of the country than the paintings, and probably nothing else conveyed a clearer idea of the genius of the people and the conditions which environ them. It would be a pleasant duty to notice these

in detail, not alone for the artistic skill shown, but still more because they reveal many aspects of life in Norway which can be seen only through the eyes of the painter, unless one is privileged to study the economic conditions of the people and to share with them experiences, often of danger and privation, that few care to meet. But the limits of this report preclude it, and the briefest mention must suffice, except in a very few cases where the life and experiences of the fishermen are delineated. That the fisheries have furnished inspiration to Norwegian artists was too apparent to admit of a doubt, and the numerous canvases devoted to these industries or closely related subjects indicated how rich a field lies open to the painter in this land of the midnight sun, of midday night, of towering snow-capped mountains, of fierce storms and howling gales, and of brave, hardy, self-denying men and women, who labor on courageously and almost defiantly in their efforts to overcome the obstacles with which nature confronts them; and, despite it all, to exact sufficient tribute from her to sustain themselves along the ironbound rugged coasts, or on the limited areas in the narrow valleys between the mountains, or the slopes that fringe the fjords.

The most impressive of the paintings was a large marine view, by Hans Dahl, entitled Bad weather. It is a realistic depiction of one phase of life frequently experienced by the fishermen and their families, the women of which are generally trained from early childhood in the management of boats.

The artist is fortunate who can reproduce nature faithfully, as in this case. An open fishing boat, under spritsail and jib, is seen scudding before a rising gale, which tears the tops from the waves and sends the spoondrift scurrying off to leeward, while the dark, windy-looking clouds that sweep past the distant mountains presage danger to those on the little craft.

The bareheaded old fisherman at the helm turns his wrinkled face anxiously to windward, his snow-white locks and whiskers streaming in the wind. His daughter, with that skill and fearlessness that Norwegian women acquire by familiarity with the sea, is leaning at the bow, unhooking the tack of the jib, preparatory to taking it in, while a little girl of five or six years crouches amidships, but shows no signs of fear. Both boat and water seem to move. The former is just rising on the slope of a passing wave; her sails stand out hard and full; one almost imagines he hears the whistle of the gale and the swish of water as it goes seething by, and one feels in studying this painting a fuller appreciation than ever before of the perils the coast people are always liable to meet whenever they venture forth in the carriage of the fjord, the fisher's boat, that all must learn to use.

Two smaller canvases by Hans Dahl, though well executed and distinctively Norwegian, were much less impressive than the one men-

MACHINERY HALL.

Photographed by Nyblin.

tioned. One of these, entitled Happy Girls, showed how three young peasant girls managed to play a practical joke on a sturdy young fisherman who, perhaps, was a little too vain of his personal prowess and knowledge of boats.

They are about to cross a fjord, and the young man strains, tugs, and pushes at the boat's bow in the effort to launch her, but she will not move, while his two companions stand by, laughing and taunting him with his lack of strength, their chief effort being to distract his attention, so that he will not see the rope they have tied around a projecting stone and the rowlock on the side opposite to where he stands, thus holding the boat firm despite all his endeavors. One of the trio, near the rope, is sedate-looking enough, and is evidently encouraging the outlay of greater strength. One feels disposed to laugh with the mischievous maidens.

The other painting represents a bridal party embarking in boats for a trip across the fjord to the church, where the marriage ceremony is to be performed. A wedding procession on the water is one of the common episodes of peasant life in Norway that is both unique and interesting.

A scene in Svolvær, by Chr. Eggen, conveyed a good idea of conditions at this celebrated fishing station of Lofoten on a fine afternoon in late winter, when the codfishery is at its height. The day's success in fishing and fair weather combine to make this picture of the fisherman's life cheerful and inspiring. The fleet of fish-laden boats—hundreds of them—are coming into the harbor from the fishing grounds in the fjord beyond the snow-covered jagged peaks that guard the entrance, and the setting sun throws a gleam of soft radiance over the mountains and the square sails of the Nordland boats, some of which are still so far off that their canvas looks like the tip of a gull's wing on the distant horizon.

The bluish shadows in the foreground contrast strongly with the beautiful tints of light beyond, and would seem an exaggeration in any place but Norway, where light and shade contrast so strangely.

Another large painting of Svolvær, by Gunner Berg, shows the inner harbor under the ordinary conditions that prevail in winter. In the foreground is a fleet of jagts, skoite, and fishing boats. The latter are gathered around the larger craft which assemble at Svolvær in winter to purchase fish as they are brought in from day to day. The gray, sunless sky is almost of the same shade as the snow-covered mountains that guard the harbor, and the outlines of which are so indistinct that they can scarcely be seen. The picture gives one a good conception of the gloominess of the dull, sunless winter days that hang over Lofoten for the most part during the codfishing season.

The painting of a Nordland Cove, by Henrik Backer, delineates another phase of a fisherman's life in Nordland. It represents a storm

such as often prevails on the coast at Lofoten and vicinity during the fishing season. One sees a fleet of fishing boats hauled out upon the beach above the sea, while the spoondrift of surf mingled with thickly falling snow is driven shorewards by the fierce winter wind — a realistic scene which speaks volumes of the dangers which beset the fishermen when caught out in their frail boats in such a hurricane, as, alas, is too often the case.

Halfdon Strøm's Rest after Work tells still another story of the primitive life of Norwegian fishermen. This shows the interior of a fisherman's cottage at evening, when the day's toil has ceased and rest is sought to recuperate strength for the morrow's labor. The interior which the artist shows is rude and simple to a degree. The log walls of the structure are revealed in the subdued light that comes from the fire on the hearth, and against the walls of the hut are rough board bunks, which serve as beds for its inmates. In two of these men are sleeping. One old man sits on the side of another bunk, in which his wife is sleeping, while he calmly smokes his pipe and evidently meditates over the work of the day just past before turning in. Scattered about the floor are the fishermen's boots, shoes, and outer garments, as they have been carelessly thrown off.

Another glimpse of domestic life in Norway is given by Helen Gundersen in her painting entitled, The Baby Sleeps While Mother Works. The infant lies sleeping in a wooden cradle in the center of the room; two larger children, although yet of tender years, stand quietly by, evidently ready to soothe the baby again to sleep if there are any indications of wakefulness. Meantime the mother works steadily at a loom in the corner of the cottage, her occupation evincing the universal industry that obtains in Norway.

Besides the above, which have been mentioned at some length, because they depict various aspects of the fisherman's life, there were many other paintings deserving of extended notice. It is, however, practicable here to briefly refer to only a few of them.

Skovsfjorden, near Mandel, by Almedus Neilsen, is a fine picture of Norwegian scenery, where the glory of summer on a fjord, with the hills, mountains, and water, make up a combination of almost indescribable grandeur and beauty.

Strong Wind and Fine Weather, by the same artist, shows one of the many conditions met on the coast. It represents a large boat coming in from sea, her reefed sail suggesting the "strong wind" which prevails, while the blaze of sunlight streaming across the fjord, lighting up the waves until they glisten like molten silver, tells of the prevalence of "fine weather," despite the rough seas beyond the headlands.

Harriet Backer, in her Game of Cards, shows four young men playing cards on a plain deal table in a peasant's cottage. This is a

side light on the life of the peasantry, and teaches a lesson of their amusements.

One view of farm life is shown, by A. Askevold, in Cows Returning Home. This is a summer scene, and the representations of cattle with the attendant maiden and the natural glories of the season deserve commendation for the faithfulness of portrayal.

The antithesis of the above was Winter Time, by G. Stenersen. The prevailing snow which this depicts, the cottage seen dimly in the middle distance, and the pony urged by his driver, sturdily pulling a sled load of wood along the country road, make up a scene entirely in harmony with conditions in Norway when the sun hangs low on the southern horizon. It also suggests that the storm has no terrors for the hardy peasant or his dumb companion.

Who Can It Be, by Sven Jorgensen, illustrates a human weakness that is not confined to the rural districts of Norway. The old cottagers, man and wife, peer out of a window at a passer-by; their intense curiosity, written on every lineament of their wrinkled faces, evidences the appropriateness of the title.

Hauling a Lifeboat on the Coast of Holland, by Elizabeth Sindeing; After Bad Weather, a scene on the Dutch coast, by Fr. Smith-Hald; and A Fishing Harbor, Loch Fyne, and Sannox Bay, Scotland, by Hans Gude, indicate that Norwegian artists have occasionally been tempted to portray other scenes than those which their own country is so celebrated for.

The many portraits, some of them showing exceptional skill, and the treatment of other subjects also point to the fact that the painter's brush is by no means limited to mountain scenery, the beauties of rural life, the perils of the coast, or the picturesque features of the fisheries, all of which must be alluringly tempting to the artist's imagination.

Christ and Mary, by Marcus Gronvold, was a good example of Norwegian painting of Scriptural subjects.

Hans Hynerdahl, in his painting entitled Tell Me What I've Done, deals with a subject as old as humanity, but never uninteresting. The artist paints a misunderstanding between lovers. The maiden is evidently the offended one, for she turns away, while her lover, unconscious of having offended, inquires why he is thus treated. The composition and execution are good.

The same artist exhibited an Old Fisherman, which was a fine piece of bust portraiture, with its strong wrinkled face, fisher's dress, and nets upon his shoulder.

INTERNATIONAL FISHERIES EXHIBITION.

Scope, official representation, etc.—The international exhibits were limited by the programme and classification to collections illustrative

of fish and fisheries, fish culture, and scientific investigation relating to fisheries and pisciculture.

As a rule no attempt was made to exceed the limitation thus made, but the classification was not always strictly adhered to, or its meaning was differently interpreted, hence there was, in some cases, material in the foreign exhibits not apparently germane to the fisheries.

Aside from the United States, the exhibit of which has been dealt with in another section of this report, the following countries were officially represented at Bergen: Norway, Sweden, Denmark, Russia, Japan, and France. The Russian province of Finland and the French province of Tunis were also officially represented; their respective exhibits were made distinctive and separate from others, and in each case so as to illustrate the industries of those countries. For the sake of clearness, as well as political relations, they will be associated with the countries of which they form a part.

There were individual exhibits from the following countries, which were not, however, officially represented: England, Germany, Italy, Spain, and Belgium.

Some of these unofficial exhibits were exceptionally good and instructive, as will be seen by reference to them hereafter to be made.

NORWAY.

General considerations.—Considered from the standpoint of fisheries, probably no country on earth holds a more important position, in proportion to its population, than that occupied by Norway. The rugged nature of the coast, often precipitous, and with only a limited amount of tillable land, and the fact that its waters abound in fish, which at certain seasons appear in phenomenal numbers, have all contributed to make fishing a leading industry for many centuries, particularly since the art of curing herring by salting was discovered. For this reason, and especially because the Norwegians have found it necessary to apply scientific methods to their fisheries, so far as their means admit, it seems desirable to discuss their apparatus and methods, as represented at the exhibition, and to allude to certain matters connected therewith, which may contain suggestions of possible utility or benefit to American fishery interests.

No comprehensive statistics of Norwegian fisheries were exhibited, and none have been published, so far as I am aware, which show in pounds or tons the total amount of fishery products. It is customary, in presenting the statistics of the Norwegian cod fishery and its allied branches, not to give the weight, but the number of fish, hence there are no data extant showing the weight, which can only be estimated.

Nor is the system of determining the number of fishermen employed satisfactory, since it only shows the number engaged in special fisheries at certain seasons, and there is nothing to indicate how many of these change from one fishery to another, and apparently no data upon

HORTICULTURAL EXHIBIT.

Photographed by Nyblin.

which the total number of fishermen in the country can be accurately arrived at.

Notwithstanding all this the official figures available are sufficient to show the important position held by Norway in the fisheries, and to what extent she contributes to the supply of marine food in the various markets of the world. For this reason, and because it serves as a basis for a clearer understanding of the statements which follow, I venture to give the following statistics:

The total number of fishermen employed is estimated at 95,000, of which 35,000 are at Lofoten in the season and 31,000 in the fat-herring fishery.

The average annual catch of cod in Norway, in the period from 1891 to 1895, inclusive, was 65,000,000 fish in number; of these, 34,000,000 were taken at Lofoten. In the same period the annual catch of whales off the Finmarken coast was 900, with an aggregate value of 975,000 kroner, equal to $263,250.

The average annual value of the catch in the principal fisheries, at prices paid the fishermen, aggregated 23,897,000 kroner, equal to $6,452,190, divided as follows: Cod, $3,723,160; pollock, ling, and cod (other than those above), $804,060; fat herring (summer catch), $682,020; spring herring, $591,840; salmon, $196,830; mackerel, $118,530; sprats, or small herring ("brisling"), $103,950, and lobster, $96,390.

The maximum annual value of exports, taking the highest price reached with any product during this period (1891–1895) was $12,933,000; and the average value was $12,562,560. These exports included oils to the value of $1,652,400.

The exports of fish go to the following countries; they are of the kinds indicated, and have the values stated:

Spain.—Nearly all dried cod (klipfish), a few smoked fish, $3,247,290.

Germany.—Chiefly fat herring, klipfish, and stockfish; also a large amount of whale and seal oils and medicinal cod oil, $2,628,720.

Great Britain, including Ireland.—Mostly klipfish; whale and seal oils, medicinal cod oil; salmon; also fat herring, stockfish, etc., $1,784,430.

Sweden.—Largely fat herring and pollock, $1,171,800.

Austria and Italy.—Principally klipfish and stockfish, $970,650.

Russia.—Mostly fat herring, stockfish, pollock, and klipfish, $812,970.

Netherlands.—Chiefly stockfish and oils, $719,000.

Denmark.—Nearly all fat herring and lobster, $431,460

France.—Mostly cod roe, $314,550.

Portugal.—Wholly klipfish, $297,270.

United States.—Chiefly fat herring, mackerel, and medicinal cod oil, $64,800.

Since the date for which these figures are given (1891 to 1895) the exportation to the United States has increased materially. In the year ending June 30, 1898, there were exported to the United States from the Bergen consular district alone fishery products amounting to a total value of $541,268.25. These were divided as follows: Anchovies, $19,340.84; canned fish, $22,642.12; stockfish, $61,711.69; salt herring, $221,508.79; salt mackerel, $98,879.14; fish skins, $2,529.11; cod-liver oil, $65,751.97; sardines and anchovies in tins, $28,904.59.

Belgium.—Largely klipfish, but many other varieties, $49,140.

Finland.—Chiefly klipfish and fat herring, $48,870.

Other countries.—$10,800.

Fishing vessels and fishing boats.—The fishing fleet of Norway is one of the most interesting to be found in the world. In the Norwegian fishery craft of to-day are seen many of the peculiar characteristics that distinguished the viking ships of a remote period, in which the famous navigators of Scandinavia pursued their voyages.

"Little, if any, change appears to have been made in northern naval architecture," remarks Boehmer, "for in the Northland boats of the present day we recognize the oldest forms known to us from the rock sculpture (*Hällristninger* or *Hallbristninger*) discovered in Sweden and Norway, with an antiquity reaching far back into prehistoric times, and supposed to have originated from boat-shaped stone burial groups (*Skibssætninger* or *Stenskjæpper*) supposed to have been erected during the transition time from the bronze period to the iron age in Scandinavia, and from boat remains found at various times and places, representing structures dating from the third to about the ninth or tenth century of the Christian era."[1]

The remarks quoted apply chiefly to open boats, but it must be conceded that, while the steamers are of course modern, and improvement is noticeable in some of the sailing vessels, certain types of the latter are evidently of ancient origin, and other forms indicate little advance.

It is somewhat difficult to understand the extreme conservatism of the Norwegians in the matter of boat and vessel construction. Nothing connected with the prosecution of commercial fisheries is of greater moment than having boats and vessels well adapted to the purposes for which they were designed. The questions of strength, safety, speed, and suitable capacity are all of much importance, and the highest combination of these to meet the requirements of special conditions is what is needed in a fishing boat. It is evident, however, that consideration must be given to the cost, a matter that can not be overlooked, when the means of those who own and operate boats or vessels are so limited that expense must always be kept at the lowest practicable point. I am satisfied that this has much to do with the remarkable conservatism that has continued for centuries, but it is not sufficient

[1] See Norse Naval Architecture, by George H. Boehmer, in Proceedings of the United States National Museum, 1886, p. 444.

excuse for certain conditions in construction or rig which might be materially improved without additional cost. More specific reference will be made to this matter elsewhere.

The greater part of the Norwegian fishing fleet is composed of open boats, some being simply rowboats, while others depend chiefly upon sails for propulsion. With comparatively few exceptions, these boats have a sharp stern, a feature that dates back to prehistoric times. Some of the larger decked vessels are also sharp aft, but most of the fish freighters and some others have square sterns.

The vessels employed in the Norwegian fisheries include several types that are used for freighting only, devoting the larger part of each year, or possibly all of it, to the fish business, though some engage in general freighting "between seasons," carrying wood or other products, from point to point, but chiefly from the country districts to the towns. Most of these vessels are used for receiving and salting the catch of cod or herring that is purchased from day to day, and others serve as homes for seine fishermen, who move from place, following the migrations of fish.

Steamers.—Steam vessels have been little used in the Norwegian food-fish fisheries until recently, though they have been employed in the whale and seal fisheries for some years. The tendency of the times is strongly in favor of increasing the steam fleet, and it is probable that steam liners, and possibly trawlers, like those of Great Britain, may soon be engaged in the Norwegian ocean fisheries.

Finmarken whaling steamers.—A small fleet of screw steamers is employed during each season in whaling in the Arctic Ocean off the coast of Finmarken. In 1896 the fleet numbered 29 steamers with an aggregate tonnage of 730 tons; the crew numbered 544 men; and they caught 1,212 whales.

The species sought are the blue whale (*Balænoptera sibbaldi*), finback (*B. musculus*), sei whale (*B. borealis*), and humpback (*Megaptera boops*).

These steamers, with one exception, are owned south of Tromso, chiefly at Tonsberg, Sandefjord, and Christiania. They are schooner-rigged, built of iron or steel; usually about 75 to 85 feet long; 14 to 16 feet beam; 20 to 30 nominal horsepower, and resemble the fishing steamers of Great Britain. A whaling steamer, fully equipped, costs from $13,500 to $16,200.

A large engraving, from the painting by Professor Saltzman, of the whaling steamer *Duncan Gray*, on which Emperor Wilhelm II witnessed the killing of a whale, was exhibited by M. Jorsen, of Tonsberg (fig. 9).

A typical arctic whaling steamer has a moderate sheer; sharp bow, with convex water lines; stem almost vertical above water line, but tumbling in slightly at top, and curved below to join the keel; rather low floor; round bilge; fine run; round stern; two pole masts, fitted

to carry small sails, which, however, are little used. The mainmast steps in the forward part of the quarter deck, which is somewhat higher than the main deck. The foremast stands well abaft the stem, and the smokestack is between the two masts. Boats are carried on side davits, high above the rail. One of these is generally a praam and the other a whaleboat, but they are seldom used. There is a "crow's nest" at the foremast head, a large cask fastened to the mast, so that the man on the lookout for whales can stand in it when on watch, and thus be safe and partially sheltered from the icy arctic wind.

FIG. 9.—Killing a whale off Finmarken. (From painting by Prof. Saltzman.)

A little abaft the stem head is a small cannon, from which is shot a large wide-flued harpoon that fastens into the whale, and also carries with it an explosive bomb to kill the animal. Just forward of the gun an iron bridge is arranged on hinges, so that it can be elevated or turned forward to a horizontal position. This platform is 9 feet wide and 6 feet long, fore and aft. When a steamer is hunting for whales the bridge is turned forward and some 20 fathoms of the large harpoon warp is coiled in front of the gun, so that there may be rope enough to easily reach a whale when the harpoon is fired, although it is a rare thing to attempt to shoot a "fish" more than 15 fathoms off. About 300 fathoms of warp is carried.

STEAM-WHALING BARKENTINE RAGNVALD JARL.

From painting.

These steamers are equipped with steam winches for raising the whales after they are killed, for they often sink and can be saved only by a strong warp and the wide-spreading flues of the harpoon, which are generally sufficient to stand the strain of bringing a dead whale to the surface; when it is properly secured and towed to the station. To ease the strain on the towline, some steamers are fitted with a rubber accumulator to the foremast, and in a rough sea the flexibility of this device lessens the effect of a jerky motion of the vessel and decreases the chances of losing the whale.

The following are the principal dimensions of one of these vessels: Length over all, 81 feet; beam, 16 feet; depth, molded, 9 feet; foremast, above deck, 41 feet; mainmast, above deck, 20 feet.

Bottle-nose whaling steamers.—The steam vessels employed in the fishery for the bottle-nose whale (*Hyperoodon rostratus*) differ radically from those on the Finmarken coast, as will be seen from the illustration of the steam barkentine *Ragnvald Jarl* (Pl. XVIII), copied from a painting exhibited by Kraasbye Brothers & Co., of Aalesund.

These vessels are generally small wooden barks and barkentines, ranging from 100 to 120 tons in size, carrying substantially the same amount of canvas as a sailing vessel, and being equipped with auxiliary steam power, with a two-bladed screw that can be raised when the pressure of ice makes it necessary.

In addition to the vessels that engage exclusively in the pursuit of the bottle nose whale during the season, usually more or less of the sealing steamers hunt this species after the close of the spring sealing. These vessels are much larger than those which find their principal employment in the bottle-nose fishery, averaging about 230 tons each. They are described under the head of sealing steamers.

A model was exhibited of an auxiliary steam bark employed in the bottle-nose whale fishery. This represented a wooden vessel about 100 to 110 tons register, of the conventional half-clipper type, with well-shaped bow and run, full midship section, and a two-bladed screw. A large "cutting-in board," made of planks, extended from the rail to below the water line and was about 13 feet long on the vessel. Supported by a special stay, extending from the mainmast to the foremast head, were two large cutting-in tackles used for hoisting in the blubber, and an iron steam winch just forward of the poop deck furnished the power for operating the tackles.

The poop deck, flush with the main rail, extended forward nearly halfway between the mizzen and main masts. Just forward of this was the smokestack. The bridge extended from side to side of the ship across the forward end of the poop, above which it was elevated about 5 feet. It was sheltered with canvas wind-breaks. The topgallant forecastle deck, underneath which was the forecastle occupied by the crew, was unusually long, for it reached abaft the foremast. Two

stanchions on each side at the bow and one stanchion on each side of the poop were fitted to support the swivel harpoon guns used for killing bottle-nose whales, which are sometimes shot from the vessel as well as from boats.

A pole mizzenmast, rolling topsails, and no sails above the latter were the chief peculiarities of rig. A "crow's-nest" for the lookout was on the main topgallant mast.[1]

Vessels of this class are fitted with iron tanks to receive the blubber, which is not tried out until after it is discharged at the home port. These tanks vary in size, according to the shape of the vessel's hold, which they are made to fit, and have a capacity of from 10 to 30 barrels. Large casks are also used. The tanks are filled with water for ballast at the beginning of a voyage.

A steamer will carry from 5 to 8 open boats, which are 20 feet long, 6 feet wide, and 2 feet 8 inches deep. They are stout, carvel-built, keel boats; with curved, raking stem and sternpost; V-shaped square stern; 5 thwarts and a half deck forward for 4 feet abaft the stem. In this half deck is a stanchion, on which is mounted the swivel harpoon gun that is always carried on boats which hunt the bottle-nose whale.

The following are the principal dimensions of the bark represented by the model alluded to: Length over all, 104 feet; beam, 20 feet; depth, 10 feet; length of topgallant forecastle deck, 31 feet; poop, 32 feet.

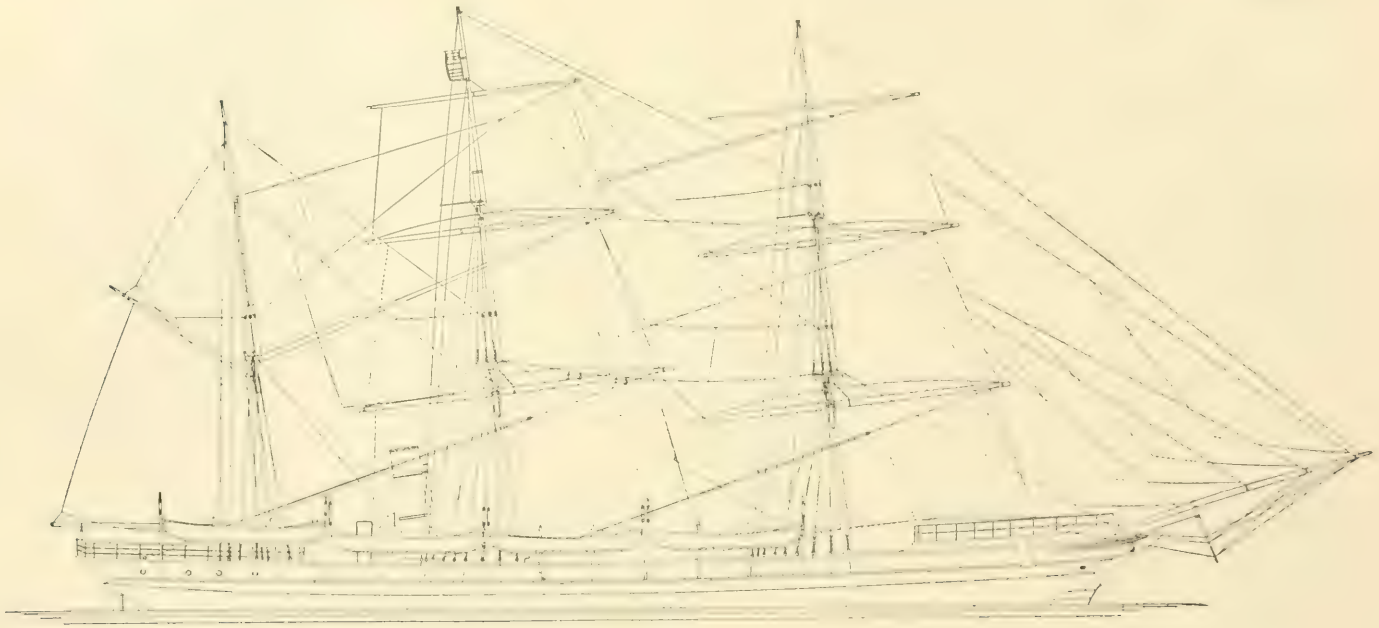
Sealing steamers.—Among the vessels employed in the seal fishery are some auxiliary screw steamers of a type similar to those engaged in the industry from Dundee, Scotland, or St. Johns, Newfoundland (Pl. XIX). They average something over 230 tons register. In 1896 the fleet consisted of 18 steamers, aggregating 4,188 tons and carrying 853 men. As has been stated, some of these engage in the whale fishery after the spring fishery for seals is ended.

These steamers are generally bark rigged and are fitted to carry a full complement of sails, but light sails and spars are generally sent down and stowed away when working in the ice packs. The two-bladed screw propeller is so fitted that it can be lifted in case of a nip.

The greatest strength is required in vessels that must enter the ice, and experience has proved that only those built of wood can endure the strain that sealers have to encounter. Consequently only the best wood is used in the construction of the hull, oak and American rock-elm being in high favor. Outside of this, from the keel to above the water line, is a thick sheathing of green heart, ironwood, or some other exceptionally hard and durable wood.

The bow of a sealing ship, for several feet abaft the stem, is built up

[1] In most cases the "crow's-nest" is on the fore topgallant mast, as shown in the illustration of the *Ragnvald Jarl*.



SEALING AND WHALING STEAMER.

Drawn by J. W. Collins.

solid of deadwood, and the outside sheathing comes flush with the forward part of the stem. This gives enormous strength to this part of a vessel.

The bows are further strengthened inside by diagonal oak logs, and outside of the stem is a heavy iron plate, 2 to 3 inches thick in the center, carried to the keel, and iron plates to protect both sides of the bow, from top of doubling down below the water line.

The stem itself is very thick and usually has a strong rake, which is of advantage when a ship is working among ice, for with good headway she can push her slanting bow upon a floe, when the combined weight of the vessel and force of the blow will often break the ice and open a passage for her to proceed.

The crow's-nest is secured to the fore or main royal mast, and a supply of boats is carried at the cranes or on deck.

Market fishing steamers.—In the past few years there has been a marked change in the vessels engaged in deep-sea fishing, especially in the market fishery from Aalesund, and Norwegian-built iron steamers have come into favor for the long-line fishery from off Cape Stadt north to Christiansund, and even on Storregen Bank in summer. Their catch of cod, halibut, or ling is marketed daily, and their adaptability to the market fishery, as compared to the sailing vessels, is so immensely superior that the latter are being transformed into steamers by having an equipment of boiler, engine, and screw propeller added. The vessels so transformed are chiefly the round-sterned bankers "banskiote" which retain their general characteristics, hereafter to be referred to.

Not having been built for steamers, they are not so well adapted to their work, even after transformation, as vessels specially designed for working under steam, but the change is an improvement. The vessels are sturdy and seaworthy, and, even if rather slow under steam, it is believed they will give a fairly good account of themselves.

The steamers specially designed for this fishery are about 70 feet long, 16 to 17 feet beam, and 8 or 9 feet deep; usually with schooner rig, and resembling in general appearance the small steam liners of Great Britain.

A steamer of this kind will cost double as much as the large sailing skiøte, but it will catch so many more fish that its earnings for both crew and vessel are much larger.

It is an interesting fact that the employment of steamers in the Norwegian line fisheries for cod, halibut, etc., has led to the adoption of the American dory, which, as is well known, is peculiarly suited to this fishery, and is gradually making its way in various parts of the world where long-line fishing is prosecuted in boats going out from vessels.

Builders' models of steam liners were exhibited, and a painting by O. A. Ekren, of Aalesund, showed two of these vessels working off Cape Stadt in a fleet of sailing vessels and boats.

Bait steamers.—A considerable number of small steamers, of varying sizes and designs, engage in supplying bait for the cod fishermen at Lofoten and Finmarken during the seasons.

These vessels are bait carriers in the strict sense of the term. At other times they find employment elsewhere, and it seems unnecessary to refer to them at length.

Fish-carrying steamers.—During the height of the herring season it is common for coasting steamers to engage in carrying herring from Norway to British ports. But, inasmuch as this is not a permanent or regular business and is only incidental to their usual trade, and also because they have not been designed for the fisheries so far as I am aware, a passing allusion to them must suffice.

Steam whaling launch.—In carrying on the bottle-nose whale fishery, and the fishery for white whales, steam launches are sometimes employed. Captain Thompson says that "a vessel pursuing the bottle-nose whale carries two or three launches."

A screw steam launch such as the Norwegians use for whaling is carvel-built, of oak. It is entirely open, with a sharp bow, round bilge, rather long midship section, a short run, no overhang, and a nearly vertical, V-shaped square stern. It is equipped with harpoons, and a small steel cannon for shooting whales is mounted on a pivot at the bow.

The following are the dimensions and other particulars: Length, over all, 27 feet; beam, extreme, 7 feet; draft of water aft, loaded, 2½ feet; cannon, 1½-inch caliber; speed of launch, 8 miles per hour. It has an ordinary inverted, single-cylinder, noncondensing engine, with cast-iron standards. Diameter of cylinder, 5 inches; length of stroke, 7 inches; number of revolutions per minute, 200. The boiler is of the straight through, dry-ended type, with small fire box and no combustion chamber. Length of boiler, 4 feet; height, 3⅛ feet; number of 2-inch tubes, 410. There are 2 coal boxes, one on each side of the boiler, the dimensions of those being: Length, 3½ feet; width at top, 16 inches; depth, 2 feet.

Cost: Boat complete, but without shooting apparatus, $900; steel cannon, complete, with stand, $175; shooting harpoons, $25; hand harpoon, $15; hand lance, $5; boat anchor, $2.50.

Sailing vessels and boats.—There are many varieties of sailing craft employed in the Norwegian fisheries, with which may, perhaps, be properly included the fish carriers, fishery police boats, and life-saving boats, which really form a part of the fishing marine. Most of these were exhibited either in full size or models.

The boats of many of the principal fishing districts usually have marked peculiarities of form, construction, or rig which distinguish

them from fishing craft in other sections of the country. The fishermen of each section, according to Norwegian authorities, are generally much prejudiced in favor of the boats they use themselves, often believing them far superior to those of their brother fishermen in a neighboring district, while the latter, in turn, are as fully convinced that their own boats are better than others.

But this appears not to be an invariable rule, even if it is a common prejudice. So far as the decked vessels are concerned, with few exceptions they seem to be very generally employed along the coast. "Although there are distinct types of vessels," remarks Holmboe, "differing very much from each other, it can not be said that a certain model is used for a special kind of fishing. Neither is it possible to tell to what part of the country a certain model properly belongs. These different types of vessels used in the fisheries are represented in almost any port, and are found in almost any kind of fishing or trading." It is self-evident that this does not apply to the vessels used for cod fishing on the banks. The Norwegian bank skiote is used for no other purpose, and no other kind of vessel (with a few exceptions) is used in this fishery.

The Nordland jægt. Bergen is the principal port where are gathered for exportation the products of the Nordland fisheries, chief among which are the stockfish- cod dried without salt -dry salted cod, or klipfish, cod roe, and cod-liver oil. A remarkable type of vessel employed in transporting these products from the various Nordland fishing stations to Bergen (and perhaps to other less important ports) is called a "jægt" (fig. 10), a name which is applied to a single-masted vessel, with movable deck, carrying one or two square sails, and distinct from the type known as "jagt," which has a fore-and-aft rig.

The jægt is peculiar in form and rig, and, according to Norwegian traditions, has remained almost entirely unchanged in both for many centuries. It is even believed by some that the Norsemen came to America in such a vessel about one thousand years ago. The spirit of improvement which characterizes the present age has made some slight changes in the modern-built jægts, which will be noticed farther on, but the old-style craft is still employed, and clinker-built vessels of this type may still be frequently seen at Bergen. Following is a description of one of them: The hull is very broad and full; the stem curves considerably below and rises vertically 8 or 9 feet above deck. The bow is bluff and round, the bilge low, there is no overhang to the counter, and the stern is excessively full and square, giving the vessel the appearance of having been cut in two in the middle and only the bow portion left. It has a keel of medium depth, and little or no run. The rudder hangs outside, and is square at the heel; a boat is carried at wooden stern davits, which are like those in use on American fishing vessels fifty years ago. A little more than three-quarters of

the vessel's length, from aft forward, is a raised bulwark, or waist, some 3 or 4 feet higher than the bow, and between these elevated sides the deck is not permanently secured, but consists of movable aprons, which may be raised to the middle height of the mast, to cover the dry fish that are piled high above the rail when the vessel is loaded.

Vessels of this kind usually have two cabin windows in the stern, or painted representations of windows. The custom of having stern windows on coasting vessels, which was very prevalent fifty or one

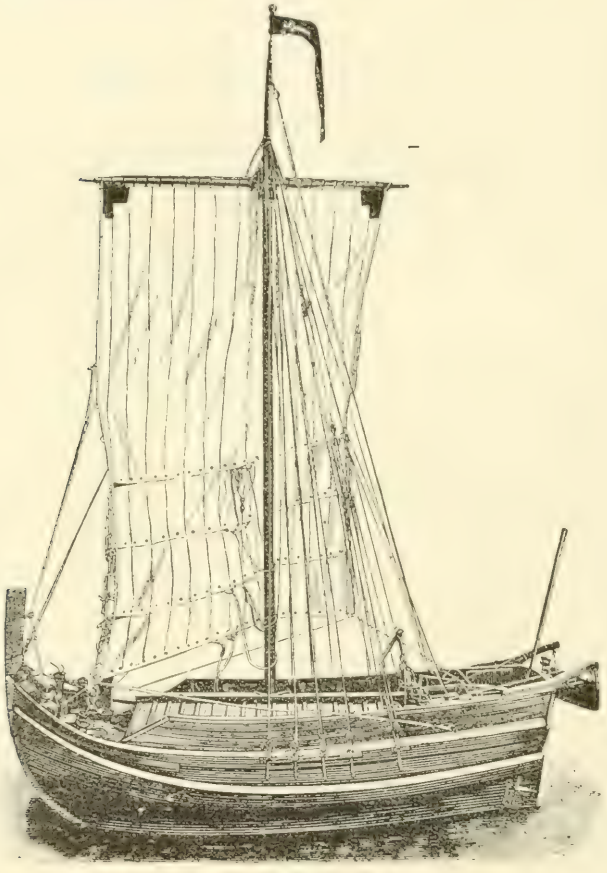


FIG. 10.—Nordland jægt.

hundred years ago, has generally been abandoned, except on the jægts of Norway.

The rig consists of a single mast, stepped almost in the center of the vessel and standing as nearly upright as possible. This is supported by four shrouds on a side, in addition to backstays, while a forestay sets up at the stem. A single square sail, with three bonnets, is used, in the upper corners of which are black patches that are still carried by some of these vessels at least, as emblems of mourning for a famous

poet and priest. Peter Dass, who lived in Nordland from about 1650 to the early part of the eighteenth century, and who is said to have been much loved and esteemed by the Norwegians.[1]

Another jægt, from Trondhjem, has the same general features as that above, but is somewhat more symmetrically formed, and represents the improved type of this class of vessels. It has a full, round bow, hollow at water line; hollow floor; shallow run, and heavy, square stern; narrow, square-heeled rudder; considerable rake to stern post. The greatest beam would be about 8 to 10 feet from the stem; from this it narrows gradually to the stern. It is painted black, varied with narrow white stripes and bright varnished streaks. The windlass, which is worked with handspikes, stands well forward, about 5 feet from the stem. Just abaft this is the entrance to the forecastle, which is under deck, and on the port side is the stovepipe. The cabin occupies some 10 to 12 feet of the vessel's length, at the stern, and between this and the forecastle is the hold where the cargo is stowed, this part being covered with the movable deck previously mentioned. The cabin is below deck, and is lighted by a large square skylight just forward of the tiller, this skylight also serving for a binnacle. The cabin companion way is a small box-like affair. The pump stands at the after end of the apron or movable deck. This vessel is provided with davits for carrying two boats. A pair of nearly straight wooden davits project from the stern, while on the starboard quarter are a pair of stout upright wooden davits. The bulwarks are of moderate height, and the rails are flush on top, fore, and aft. There is little sheer to the vessel, except near the bow, which has considerable curve upward. It carries a lap-streaked, square-sterned boat, having six thwarts, and five sets of rowlocks on a side. Her rig differs from that of the jægt first described in having a jib and topsail, while the square mainsail has four instead of three bonnets in it. It may be explained here that these bonnets serve a double purpose, namely: In the first place they are removed from the sail when the vessel is loaded with fish, enough bonnets being taken off to allow the foot of the sail to swing clear of the deck, which, as has been explained, is sometimes hoisted nearly halfway up the mast, where it lies on top of the load of fish; secondly, these serve the purpose of an ordinary reef, and, when sail must be shortened because of strong winds, one or more bonnets are taken off the foot. The tacks and sheets, which

[1] Peter Dass was a Lutheran clergyman, who made long journeys in boats over his extensive diocese in Nordland. This gave him opportunities to meet the fishermen and to learn much of their lives, habits, work, dangers, and hardships; also of their families and the country. These are discussed in a book he wrote (The Nordland's Trompet), which, with his preaching, made him very popular. His death was sincerely mourned, and black patches were worn in the sails of Nordland vessels as an emblem of mourning. They may still be seen occasionally.

are permanently bent to the lower corners of the square sail, above the bonnets, follow down along the sides of the latter, to which they are secured by a number of small stops (generally four or five stops to each side of a bonnet), and are lashed securely to the clews of the lower bonnet. To the middle of the foot of the square sail, and to the foot of each bonnet, are attached lizards, through which is rove a lace-line that passes around the mast, and prevents the sail from bellying out too much. There is a bowline bridle on each leech of the sail, to which is fastened one end of a bowline that reeves through a block at the stem head. When sailing by the wind, the bowline is hauled taut on the weather side, and assists in keeping the sail flatter than it would otherwise be. When the vessel is running, the foot of the square sail is often triced up so that the helmsman can look ahead to see anything in that direction.

A peculiar sort of parrel is used on the main yard. This slides up and down on the mast; is constructed of thirteen long, thin pieces of hard wood (the central piece being the longest), straight on one side, ends rounded, and the other side hollowed out slightly near each end. In each piece are three holes, except the middle piece, which has more. A line passes through these holes and through small circular parrels, which alternate with the longer ones. When the whole are strung on lines, the parrel is fitted to the after side of the mast, where it is held by two parts of a stout rope, the bights of which go round the yard on each side of the mast. As the yard is raised or lowered this parrel is lifted or slacked down by a line rove through a block at the mast-head.

The square-sail tie, by which the yard and sail are hoisted, passes over a large sheave in the masthead. A heavy, threefold purchase is used to hoist the sail, the lower block being simply a large square standard fixed in the deck and having three sheaves in its upper end. The upper block, which hooks into the tie, is prevented from turning and thus fouling the purchase by a long leader which runs up and down on the starboard backstay.

The topsail is set from deck; the sheets reeve through bull's-eyes at the ends of the main yard, and through other bull's-eyes near the slings of the yard. Sometimes the last-mentioned bull's-eyes are secured to the parrel lashings.

She has a pole mainmast, the upper end being tapered to form the topmast. In addition to the four shrouds on a side (the starboard rigging only being rattled down), there are two backstays on a side; the after one is set up permanently, with a lanyard rove through dead-eyes, while the other is a runner and tackle purchase. There is also a topmast backstay on each side. There are two stays from the mast-head to the stem. The jib bends to the smaller stay that sets up over

an eyebolt on the stem. The topmast stay comes down to the stem head. Chain cables are used.

At the present time these vessels, while engaged in freighting fish, sail along the Norwegian coast about 600 to 1,200 miles, depending, of course, chiefly on favorable winds, since a craft of this form and rig would be eminently unfitted for beating against head winds. It is claimed, however, that these jægts will sail before the wind at a speed of 8 to 9 knots.

The following are detailed measurements of the vessel last described: Length over all, 60 feet; beam, 21 feet; width of stern, 14 feet 7½ inches; height amidships (bottom of keel to top of rail), 12 feet; bow (to top of rail), 14 feet 3 inches; stem, above rail, 8 feet 3 inches; depth of keel, 18 inches; height of bulwarks, 27 inches; length of movable deck, 32 feet 3 inches; length of stern davits, 3 feet 9 inches; mast, above deck (to eyes of rigging), 46 feet 6 inches; topmast, 10 feet 9 inches; metal vane pole, 3 feet 9 inches; main yard, 37 feet 6 inches; topsail yard, 27 feet. Sails: Jib, luff, 35 feet 3 inches; leech, 29 feet 3 inches; foot, 16 feet 6 inches; mainsail, hoist, 39 feet 9 inches; width, 36 feet; topsail, hoist, 10 feet 6 inches; head, 25 feet 6 inches; foot, 33 feet. Boat: Length, 17 feet 7½ inches; beam, 4 feet 1½ inches; depth, 18 inches.

Very little iron is used in the construction of the jægts, or, indeed, in any of the small coasters or fishing vessels, the fastening being almost wholly treenails. While it may be conceded that this type has some features which recommend it to favor, notably the movable deck, it is quite impossible to understand the conservatism that, at the close of the nineteeth century, prompts one to build vessels which can not sail to windward and must lie windbound in harbor for days or even weeks when adverse winds prevail, even if the weather is moderate.

The movable deck, or even a better protection, may be put on almost any kind of vessel, and one from a modern design, with a better shaped midship section and stern, and carrying a centerboard, would have fully as large, if not greater, capacity for the same tonnage and expense in building, and undoubtedly would prove vastly superior for all purposes.

The jagt and galeas.—The jagt (fig. 11), of which numerous models were exhibited, is a type of vessel employed in Norway for buying and transporting fish and for various other purposes, including the seal fishery. So far as its hull is concerned, it is considered by Norwegians an improved form of the jægt. The former, however, is essentially a fore-and-aft rigged vessel with a single mast, and usually carrying three or four head sails. Some have only fore-and-aft sails, but in most cases they carry, in addition to these, a square sail set flying on a stay below the hounds of the mast and inside of the forestay.

These vessels have not the high stem of the jægt and are usually sharper forward, although their sterns are very similar to those of the square-rigged fish freighters.

The following reference to this type of vessel has been made by Holmboe:

The most common and what is considered the handiest and most convenient vessel for all these purposes, fish trading and fish freighting, is the jagt, which undoubtedly in more than the name originated from the old-fashioned "jægt." Their average tonnage is, I think, about 40 tons. They have their mainmast (with no topmast) about two-fifths of the vessel's length from the bow, and carry mainsail, topsail,

FIG. 11.—Sealing jagt at Spitzbergen.

three jibs, and (like all the other Norwegian one-mast vessels) the square sail. The main boom extends about one-fifth beyond the stern. The hull may be described as something between that of the jægt and the sloop, being rather full, short, and sometimes with very much sheer. They may be found rather clumsy, but they will load well for their size and are very easy to handle when sailing through the narrow straits and estuaries along the coast. They are very stiff, and in other respects splendid seagoing vessels, and when the rather low rig is taken into consideration they may be said to sail very well. The best jagts are built in Hardanger.

A model of a jagt exhibited at Bergen represented a carvel-built, square-stern, keel vessel, with sharp, wedge-shaped bow; straight, moderately raking stem; short rising floor; short run; heavy, square stern, with no overhang, and square-heeled rudder hung outside. It had a good sheer, flush deck, a cabin trunk aft, and a cook's galley forward of the trunk. It had a modified cutter rig with boom and gaff-mainsail, club headed gaff-topsail, fore staysail (set on stay coming down to stem head), jib and flying jib, and a small square sail set on rope stay forward of the pole mast, and below the hounds.

The principal dimensions of the vessel represented by this model were as follows: Length over all, 61 feet 8 inches; beam, 17 feet 6 inches; depth, 8 feet 4 inches; mast, above deck, 53 feet 4 inches; boom, 45 feet; gaff, 30 feet; bowsprit, outboard, 11 feet 8 inches; jib-boom, outside cap, 13 feet 4 inches; lower square sail yard, 36 feet 8 inches; upper yard, 25 feet.

The galeas is simply an enlarged jagt, with a ketch rig similar to that of the fishing ketches from the east coast of England, but carrying a flying square sail like the jagt. The form and construction of hull are essentially the same. The models exhibited and the vessels I saw all had the moderately sharp wedge-shaped bow, with slight flare and straight stem, without head or ornamentation of any kind; a rising, rather sharp floor; usually a well-shaped run, but always the large, square stern, without overhang and with rudder hung outside. Vessels of this type generally have a flush deck and symmetrical sheer, and are considerably larger than the single-masted jagt, ranging in size from 40 to 100 tons, or more. They are not as a rule quite so wide in proportion as the jagt, the difference in size making a slight change in this respect preferable, and the floor is somewhat longer.

Thus, without material change in form, these larger vessels are rigged with two masts, the mizzenmast being somewhat longer in proportion to the mainmast than is common on the English ketch, or "dandy-rigged" cutter. The typical name of galeas is therefore simply a designation indicating the rig.

The large number of these vessels indicates their popularity. That the jagt and galeas are far better adapted to the purposes for which they are used than the old-style jagt is too evident to admit of discussion. At the same time candor compels the statement that they can easily be much improved, so that the carrying capacity, speed, and handiness can all be increased, not to speak of the better appearance of an overhanging stern of suitable proportions.

Norwegian bank fishing vessel.—One of the most noticeable types among the Norwegian fishing vessels is that locally known as the "Bankskoite" (fig. 12). Vessels of this class engage exclusively in the deep-sea fisheries for cod, ling, and halibut, from Aalesund and vicinity. A favorite fishing locality in summer is Storreggen Bank—

literally the Great Ledge—which lies off the west coast of Norway, where the vessels anchor and the fishermen go out in open sail boats to set trawl lines, in much the same way as the French fishermen do in the Grand Bank cod fishery.

The bankskøite is wide and deep; it has a rather full convex bow and rounding stern; the ends are shaped nearly alike, except that the bow is higher and usually has more rake than the stern. The bilge is round and easy; there is considerable rise to the floor, which is hollow in some vessels, although this feature is less pronounced in recent designs.

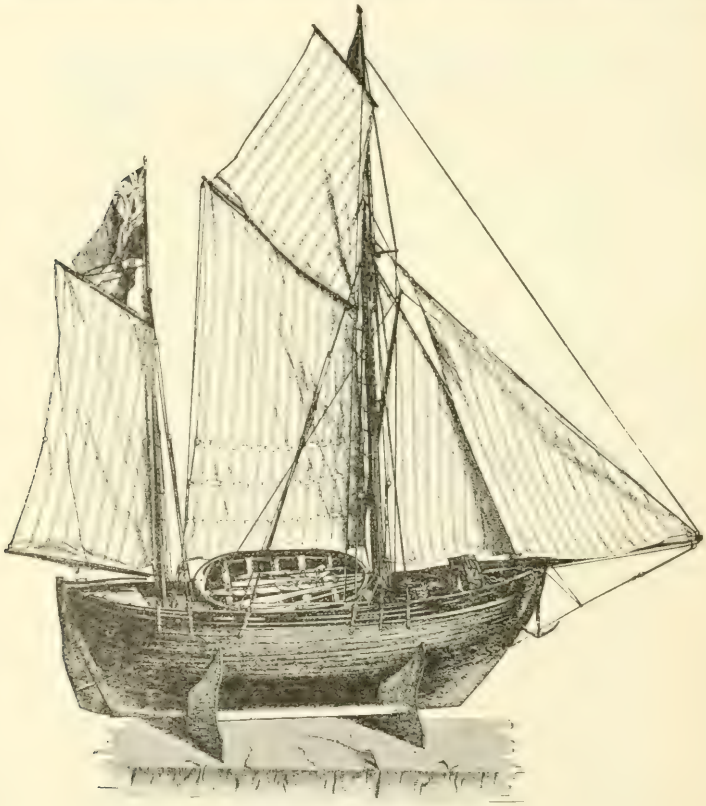


FIG. 12.—Bankskøite.

The stem curves moderately, and has a strong rake; the keel is of medium depth, while the run is rather short and the sternpost has a moderate rake, and is usually straight, but is sometimes curved near the top. The rudder hangs outside, is flush with the bottom of the keel, and is square on the foot; it is moved by a tiller. Vessels of this type have only a moderate sheer on the deck line, but the bulwarks forward are generally raised considerably by a double set of heavy bow chocks, the lower ones come aft to the after main shroud, and the top chocks reach

about half as far. The outside planking is usually hard wood and the deck pine. The old-style handspike windlass is used. Sometimes the cabin is forward, but other vessels have a cabin aft and forecastle forward.

The rig is nearly the same as that known in England as the "dandy" or ketch rig. It has two pole masts, the upper ends of which are tapered to form topmasts. The bowsprit runs through an iron band on the port side of the stem; the bobstay sets up with a tackle purchase near the outer end of the bowsprit. A permanent forestay sets up on end at the stem head. There are usually six sails, namely; jib, which sets flying; fore staysail, the sheet of which works on an iron traveler; loose-footed mainsail; mizzen, and two square-headed gaff-topsails. The lower sails have less angle to the head than English-made sails, while the heads of the gaff-topsails are comparatively narrow. There are generally two shrouds on a side to the mainmast and a heavy backstay that consists of a pennant and purchase, this being set up well aft on the weather side. A single shroud on a side supports the mizzenmast, which is sometimes provided with a pennant-and-tackle stay to keep it forward. It is of course necessary to slack this up and shift it whenever the vessel changes her tack, unless it is taken to the side. Heavy, wooden-stocked, short-shanked anchors and tarred hemp cable are carried.

Vessels of this class vary from 50 to 75 tons. The following are detailed measurements of one of them of about the average size: Length over all, 60 feet; keel, 34 feet; beam, 21 feet 6 inches; depth of hold, 8 feet; draft, 5 feet 6 inches; freeboard, about 4 feet; bowsprit, outside of band, 18 feet; mainmast, deck to hounds, 35 feet, from deck to truck, 57 feet; stem to mainmast, 16 feet; main gaff, 18 feet; main gaff-topsail yard, 7 feet; between masts, 21 feet; mizzenmast, deck to hounds, 29 feet, to truck, 45 feet; spanker boom, 19 feet; gaff, 14 feet. Sails: Jib, on luff 37 feet, foot 20 feet, leech 24 feet; stay foresail, on stay, 31 feet, leech, 28 feet, foot, 14 feet; mainsail, hoist, 24 feet, leech, 30 feet, head, 16 feet; main gaff-topsail, leech 17 feet, foot 14 feet, head, 3 feet; mizzen or spanker, luff, 18 feet, leech, 24 feet, foot, 16 feet, head, 12 feet; gaff-topsail, luff, 12 feet, leech, 13 feet, foot, 11 feet, head, 4 feet.

These vessels carry a crew of 10 to 12 men when engaged in fishing on the banks, but in the winter, when cod fishing nearer the coast, they use a greater number of boats, although these are not so large as those carried to the banks. The crew is, however, somewhat increased at this season, for besides the men who go out in the boats it is common to have two or three additional, who fish from the deck, and go on a special "lay" because of this.

Vessels somewhat similar in design, with a dandy rig, are occasion-

ally employed in the arctic fisheries and in the fish trade along the coast, but the real bankskøite is seldom used in any business besides that for which it was built.

There are many smaller cutter-rigged vessels, ranging from 10 to 20 tons, which are substantially of the same form, but these naturally come under a different class.

Reference has already been made to the fact that these large bankskøite are being transformed into screw steamers, and it is probable that the day is not far distant when the type will disappear as sailing vessels.

The skøite.—This typical name has a rather wide application, but when used alone, without modification, generally applies to a style of vessel very extensively employed as a small coaster, or trading craft, along the Norwegian coast, and also to a considerable extent in the fisheries, or for the fishery police to cruise in from point to point. It differs in form, rig, and construction from the bankskøite, but Hoimboe thinks the latter is a large and improved form of the type which bears the general name of skøite. There are also other modified or improved forms to which reference will be made in succeeding paragraphs.

The typical skøite seldom exceeds 35 tons, and is commonly clinker-built (as are also many of the jagts), but for the arctic sea fisheries only carvel-built vessels are employed, since great strength is required for encountering the ice; and the edges of the planks on clinker-built craft would soon be so badly worn as to ruin the vessel. It is sharp aft, and, in its hull, has a general resemblance to the bank vessel, though it is not so deep relatively, and usually has a low, round floor. It is always a single-masted vessel, with a sloop or cutter rig, the latter being the most common, if not universal. The special feature is the square stern, which is unique in its construction, and owes its origin, I am informed, to the necessity for carrying the boat on stern davits, since it would occupy too much space on the small deck, not to speak of the inconvenience of frequently pulling in a boat and launching it again over the vessel's side. It also adds to the deck room aft.

Instead of building the conventional form of square-sterned vessel, the Norwegian builders of this type prefer to make a sharp-sterned craft, and then to put on a sort of square stern—often called a "chicken stern"—by extending the deck and bulwarks aft of the rudder head and fastening planks across their ends. It follows, of course, that the counters, if such they may be called, are entirely flat, since there is nothing underneath the projecting afterpart of the deck.

In order, therefore, to prevent the sea from lifting and breaking this fragile structure to pieces when a vessel pounds the flat surface on choppy waves, the stern is supported by iron braces which extend downward from the underneath side of the afterdeck and are fastened

securely below. This stern is considerably narrower than the beam of the vessel, which lessens the strains it must endure, and it can be removed without doing any injury.

The following notes on a skiote used by the Government fishery police (fig. 13) will apply generally to this class, with the exception that many, if not all, of these little vessels are clinker-built, and the trading and fishing boats seldom or never have large deck houses, and are, perhaps, not quite so loftily rigged in all cases.

It was a carvel-built, flush-deck, keel vessel, with full convex bow; raking, slightly curved stem; low, narrow floor; round, easy bilge;

FIG. 13.—Fishery-police skøite.

flaring sides; short, full run; raking sternpost, curving forward at head; square-footed rudder; flat, shallow, "chicken" stern; long tiller and large cabin trunk extending from the end of the tiller to the heel of the bowsprit, and with only a narrow runway on each side. Cutter rigged, with large sail area; carrying boom and gaff-mainsail; club-headed gaff-topsail; stay foresail and jib, the latter set flying on a long, running bowsprit.

Relative dimensions: Length over all, 32 feet 3 inches; beam, 11 feet 3 inches; depth, 4 feet 3 inches; mast, above deck, 29 feet 2 inches;

topmast, heel to truck, 16 feet 8 inches; main boom, 22 feet 6 inches; gaff, 16 feet; bowsprit, outside, 13 feet 4 inches; gaff-topsail club, 8 feet 4 inches; oars, 23 feet 4 inches.

Lister skoite.—A new type of small decked fishing vessel, which is now quite extensively used in the North Sea drift-net mackerel fishery, from southern and eastern Norway, takes its specific name from Lister, where it is said to have originated. It is, however, a close copy of the boats from the southwestern provinces of Sweden. It has largely superseded the open Lister boats formerly employed in drifting for mackerel, because it is better adapted to meet the exigencies of deep-sea fishing, and can go farther to sea if necessary. It is also suitable for prosecuting the hook-and-line mackerel fishery. It usually carries 5 men in a crew and from 50 to 80 nets—an average of about 60—each 18 fathoms long and 120 meshes deep. It varies in length from 27 to upward of 37 feet, and the average capacity is about 120 barrels of fish, including what may be carried on deck. The fishing grounds are from near the land to 40 or 50 miles offshore.

The following description is based on a model of one of these boats: It is a clinker-built, sharp-ended, keel boat, with curved raking stem and sternpost; hollow floor and water lines; rather full forward and aft at deck line; very straight on top; wide, nearly square-footed rudder, curved to fit sternpost, and tiller fitted over rudder head.

It has a flush deck, with small cabin trunk aft, and large hatchway abaft the mast. On the port side of the stem is a roller for hauling the net warp over.

It is cutter rigged, with long bowsprit reaching back to the mast; the bowsprit is used as a spinnaker boom when running free. It carries a loose-footed sprit-mainsail of nearly uniform width; a stay foresail; a jib set flying, and, in light winds, a club-headed topsail, set on a long pole that comes nearly to the deck on forward side of the mast.

The principal dimensions are as follows: Length over all, 36 feet 3 inches; beam, 12 feet 1 inch; depth, 6 feet 8 inches; cabin house, 5 feet 10 inches long, 5 feet 5 inches average width, and 15 inches high; mast, above deck, 30 feet 10 inches; bowsprit, outboard, 16 feet; topsail pole, 30 feet 10 inches; topsail club, 14 feet; average width of mainsail, 16 feet; oars, 25 feet long.

The "slup."—A cutter-rigged vessel, called by the Norwegians a "slup," or sloop (fig. 14), is employed to some extent in the fisheries of Norway, but chiefly as a trading vessel or carrier. In general characteristics it resembles the single-masted fishing smacks of England, from which it has been copied; the rig is essentially the same, with the exception that the Norwegian craft carries a square sail forward of the mast for use when running free. It seldom exceeds 50 tons, and some of these vessels are considerably smaller.

It has a sharp bow; straight vertical stem; rising floor (occasionally hollow); long easy run; raking sternpost, and overhanging, shallow square stern, of the English pattern; very little sheer; flush deck; usually a cabin house aft; and often davits on the quarter for carrying a boat.

The mast stands a little more than one-third the vessel's length from the stem, and is nearly vertical, with a long topmast. It has a boom and gaff-mainsail; a narrow club-headed topsail; stay foresail, jib set flying on a long running bowsprit; usually a jib topsail, and the square sail heretofore referred to. A peculiarity of the latter is that it is generally fastened to the upper yard only at the earings (or upper

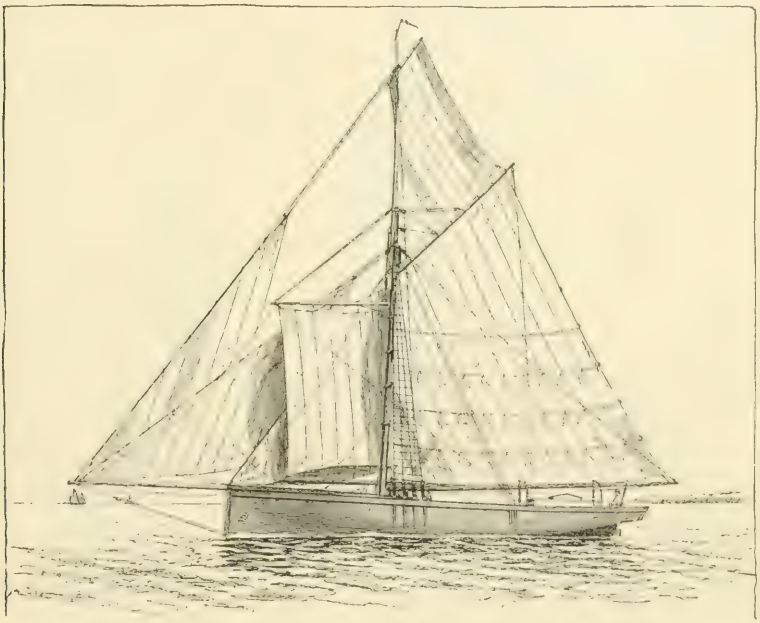


FIG. 14.—Fishing sloop. (Drawn by J. W. Collins and C. B. Hudson.)

corners of the sail), while the center of the sail is supported by the hoisting tackle, which hooks into a cringle in the head rope. This square sail is called the "bredfok" or broad jib.

These vessels are generally fairly good sailers and very seaworthy, but they do not work so well as they would if their fore foot was cut away instead of being square, as it usually is.

The following are the dimensions of one of these sloops: Length over all, 75 feet; beam, 20 feet 3 inches; depth, 9 feet 6 inches; mast, above deck, 54 feet; topmast, heel to truck, 42 feet; main boom, 51 feet 2 inches; gaff, 28 feet 6 inches; bowsprit, outboard, 28 feet 6 inches; topsail yard, 10 feet 8 inches; upper square-sail yard, 43 feet.

A builder's model of a cutter intended for the mackerel fishery had

essentially the form described above, and represented a vessel of the following proportions of hull: Length over all, 60 feet 5 inches; beam, 16 feet 2 inches; molded depth, 7 feet 10 inches.

Fishing ketches or smacks.—In recent years a number of English-built ketch-rigged fishing vessels have been purchased in Norway and have been found serviceable.

Vessels somewhat similar have been built in Norway for the deep-sea fisheries. Builders' models of these were exhibited, which embodied many of the sturdy features of the bankskøite, the chief difference being the overhanging stern, which is a decided improvement. One of them represented a carvel-built keel vessel, with moderately sharp bow, convex above, and slightly concave below water line; rising floor; easy bilge; well-shaped run; raking sternpost; overhanging round stern, and fine sheer. The principal dimensions were as follows: Net tonnage, 51.16 tons; length over all, 72 feet 11 inches; molded depth, 8 feet 10 inches; draft, extreme, 8 feet 4 inches.

Fishing schooners.—The schooner rig has not met with much favor in Norway, although some attempts have been made to use vessels of this rig in the offshore bank cod fishery.

According to Holmboe, a schooner was built for Aalesund, in 1882, to engage in bank fishing. This vessel had the following dimensions: Length over all, 70 feet; beam, 20 feet 4 inches; depth of hold, 7 feet 4 inches; tonnage, gross, 54.14 tons; net, 50.19 tons. Her cost, fitted for sea with fishing gear, etc., was $6,300.

Various builder's models of fishing schooners were exhibited, among them one designed by the writer, but there was no evidence that they were anything more than suggestions which builders displayed to attract attention. For this reason it seems scarcely necessary to refer to them at length.

Small fishing vessels.—In recent years small decked and half decked vessels, from 8 to 15 tons, have been extensively adopted for fishing purposes in Norway, particularly for the cod fishery at Lofoten and Finmarken; the market fishery at Aalesund, and the mackerel fishery off the southwestern coast. While there is considerable experimentation in the attempt to get the best form, one type of hull seems to be in most common use, with the possible exception of the sharp-sterned skøite. This is, however, not always rigged the same, and small vessels of the same model and construction are rigged as single-masted sloops, or as two-masted ketches. The latter is, perhaps, the most in favor, especially in the north.

Decked sloops.—At Aalesund small sloops are used in the bank and market long-line fisheries. According to a model exhibited by the Fishery Society of Aalesund and Sondmore, a boat of this type has the following characteristics:

It is a clinker-built, keel, decked vessel; with moderately sharp bow;

stem straight and vertical above water, curved at forefoot; rising hollow floor; easy round bilge; long well-formed run; raking sternpost; round-heeled rudder; rather flat counters; and wide, overhanging round stern. The deck is flush, with rather low bulwarks; a trunk forecastle, with raised companionway forward of mast; cabin trunk aft, and small square steersman's cockpit abaft the after house. There is one large hatch just abaft the mast, and a smaller one between that and the cabin.

It is sloop (or cutter) rigged, with pole mast, fore stay setting up to large hook at stem head, and jib set flying on running bowsprit. The fore staysail sheet and main sheet run on iron travelers.

FIG. 15.—Fishing ketch.

Vessels of this type range from about 30 to 50 feet in length; some are less, perhaps, than 30 feet in length, and few so long as 60 feet.

The following are the relative dimensions of one of them: Length over all, 38 feet 3 inches; beam, 12 feet 6 inches; depth, 3 feet 10 inches; bulwarks, 11 inches high; stern, 8 feet 4 inches wide; mast, deck to hounds, 30 feet 2½ inches; deck to truck, 39 feet 7 inches; main boom, 24 feet 4 inches; gaff, 18 feet 4 inches; gaff-topsail club, 12 feet 1½ inches; bowsprit outboard, 11 feet 3 inches; cabin trunk, 6 feet long with average width of 5 feet 8 inches; forecastle trunk, 5 feet long, 5 feet 4 inches average width.

Fishing ketches.—The small ketch-rigged vessels are generally clinker-built, and in form, construction, and relative proportions of

hull they closely approximate the sloop just described. The chief difference is in the rig, which is a compromise between a schooner and a yawl, and most nearly resembles the ketch rig of the English North Sea fishing vessels. This is distinctively an improvement in rig, introduced in the eighties and, I understand, has been quite extensively applied to the largest Nordland boats, the "femboring," which formerly carried a square sail. Indeed, these small decked, or half-decked, vessels have superseded the large open boats to such an extent that there is official authority for stating that the "femboring" is no longer built, the tendency of the times being to construct modern types.

The rig of the ketch is shown in the accompanying illustration of

FIG. 16.—Sealing boat.

one built by O. Alvig, of Tromsø (fig. 15), who exhibited a builder's model of it.

Following are the relative dimensions of this vessel, which may be taken as a type:

Length over all, 42 feet; beam, 10 feet 6 inches; depth, 4 feet 3 inches.

Sealing and whaling boat.—Many of the boats used in the seal and bottle-nose whale fisheries are alike[1] (fig. 16) and are constructed with special reference to their employment among drifting ice, or ice floes. The chief difference is in the equipment; those engaged in hunting the bottle-nose whale have a stanchion forward to mount the har-

[1]The exceptions are steam launches and square-stern boats, such as have been described. Otherwise than this the sealing boats, which may also be used for killing bottle-nose whales, are alike.

poon gun on, while those designed for sealing have an equipment for that fishery. Following is a description of one of the latter, built at Tromsø:

It is an open, carvel-built, sharp-ended keel boat, with convex lines fore and aft; curved raking stem and sternpost; rising floor; round, easy, rather full bilge; heavy gunwales and slight sheer. The stem and sternpost curve sufficiently to make it easy to haul the boat onto ice, either end first. The keel, stem, and sternpost are protected by half-round iron, and the sides of the boat are sheathed with sheet iron from amidships to the stem, for a width of 30 inches, 18 inches above water line and 12 inches below it.

It is built very substantially, having fifteen full frames of large size.

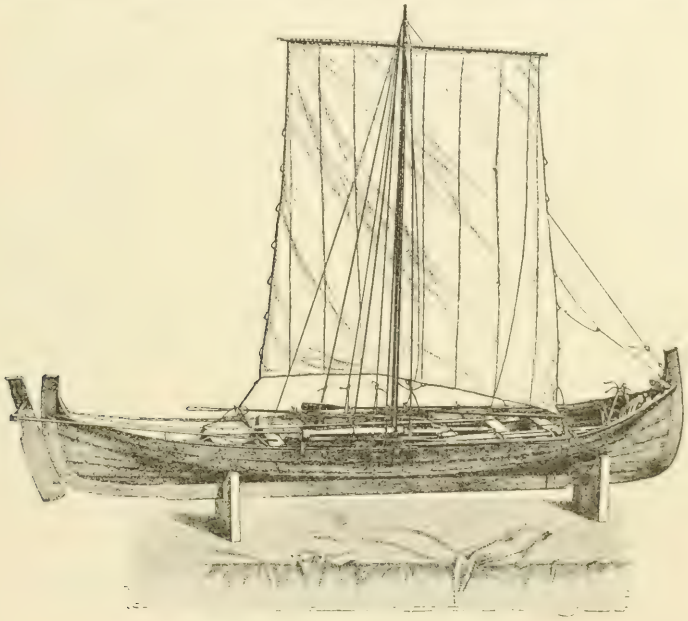


FIG. 17.—Nordland codfishing boat.

It has five thwarts and a half deck forward, the space below it being arranged to hold ammunition, etc. There is also a box on each side for ammunition. It has four rowlocks on a side, with beckets for the oars. A single square sail is carried.

The dimensions are: Length overall, 20 feet; width, 5 feet 3½ inches; depth, 2 feet 3 inches; mast, above gunwale, 11 feet 5 inches; yard, 8 feet; oars, 9 feet 10 inches.

Nordland fishing boat.—Among the many types of open boats used in the fisheries of Norway, none is more distinctive or remarkable than that known as the Nordland boat, which is easily recognized wherever it may be seen. It derives its specific name from the fact that it not only seems to have originated in Nordland the northern

section of the west coast of Norway—but is still built and used there in great numbers, particularly in the cod fishery of Lofoten.

There are various sizes of these boats, roughly classified according to the special branch of the cod fishery in which they engage. Another system of classification prevails nearly everywhere in Norway, by which a boat propelled wholly, or in part, by oars, is rated by the number of oars she is fitted for. This system obtains in Nordland, and the size of a boat is usually indicated by the number of oars she has, instead of by actual measurement. They differ, however, chiefly in size, and in certain equipments for fishery, though there are occasionally differences of rig, and a few of the largest boats have cuddies. But in all cases the type is shown so strongly and unmistakably in the hull that it can not be mistaken.

The size varies from about 18 to 40 feet in length; the smallest are used by hand-line fishermen, the next sizes for operating trawl lines, and the largest boats for net fishing. The latter, however, vary considerably, from the seven-oared boat (fig. 17) to the "femboring" (fig. 18), the largest of the type, which ranges from 36 to 40 feet in length; from 8 to 9 feet beam, and from 35 to 39 inches in depth, and carries from 10 to 12 oars.

But, while there are variations in size and equipments for special branches of fishery, the following elements are so constant as to be substantially invariable in the Nordland boat:

It is an open, clinker-built, sharp-ended, keel boat, with hollow floor and water lines; very high stem and sternpost, both of which are nearly vertical above the water line, but are curved below. It is low amidships, with flaring sides, which are generally increased in height by vertical washboards fastened to the gunwales.

It has only a fair sheer throughout the greater part of its length, but curves up sharply at each end. The bow and stern are very sharp and concave below, but flare strongly above, and are much fuller on the gunwale line. The floor is also excessively hollow, and this characteristic feature of Scandinavian boat construction is carried to such extent as to make the upper section of the floor very shallow and rather flat, thereby decreasing the buoyancy of the boat and materially reducing its free board.

The construction is crude and primitive to an unexplainable degree, which can not be accounted for on the plea that it is necessary to keep the cost of building to the lowest practicable amount. For instance, the inner edges of the stem and sternpost are so thin that there is not space for rabbets deep enough to properly receive the wood ends of the planks; hence they project, and though they are rounded, they necessarily retard the speed of a boat. The nails used for fastening have very large round heads which can not be countersunk; consequently they project all over a boat's bottom, to the great detriment

of her easy progress. In view of the fact that it is of the highest importance that the Nordland boat should pass easily through the water, since it must often be propelled by oars alone, it is impossible to understand why such crude workmanship should have been continued for centuries, and especially in recent years, when experience has shown that it is practicable to make important improvements in these particulars, without additional cost or sacrifice of structural strength, or any other desirable qualification.

The number of thwarts depends on the size of the boat and the oars carried. With few exceptions boats of this type are entirely open. Some of the largest, however, have a small cabin, or cuddy aft, under-

FIG. 18.—Nordland "femboring" or twelve-oared boat.

neath a short deck that curves up sharply to the center to give requisite height. In this the men sleep and cook, when it is necessary for them to remain on board, as is sometimes the case, especially when making trips to the Finmarken fishing grounds.

The rig is usually one large square sail, set on a mast stepped nearly in the center of the boat. The largest boats formerly often carried a topsail (set flying) over the square sail in light winds. I am informed, however, that the rig of many of these large boats has been changed in recent years, so that, instead of the old-style square sails, they now have a ketch or "dandy" rig, with fore and aft sails.

The square sail is somewhat higher than wide, and though it can be

used by the wind it is designed more especially for use when running free, the boat being generally rowed when the wind is ahead. The sail is reefed on the foot, piece by piece, as the gale increases.

The arrangement for steering is peculiar. An arm, or yoke, extends out from the rudderhead about a foot at right angles to the boat's keel, and to this is jointed a long handle or tiller, which reaches forward several feet, and with which the fishermen steers, simply by moving it fore and aft instead of putting it from port to starboard, or vice versa, as one has to do with the common tiller.

The boats employed in gill-net fishing usually have an adjustable roller attached to the side or to the bow over which the nets are pulled on board. Line rollers are also used on the boats employed in line fishing.

The crew of a boat fitted for the net fishery varies from 6 to 8 men, and the number of nets from 60 to 100. These are not all in use at the same time, but the greater part are kept in reserve to supply the place of such as may need repairs or drying, or that may be lost. From 20 to 35 nets are fastened together and set in a gang by each boat on a specified part of the fishing ground.

The Nordland boat has been the subject of much criticism because of its unseaworthiness, and the frequent disasters which have resulted in consequence, and many attempts have been made to induce the fishermen to adopt other types of boats which are believed to be safer. Little has been accomplished in this direction, however, for the fishermen still cling to the style of boat they have always been familiar with, and refuse to believe any other has so many good qualities for the Lofoten fishery. The reason for this is believed to be due to the fact that, because of its remarkably easy under-water lines and comparatively small displacement, the Nordland boat rows easier than most of the proposed new designs. This is a most important qualification, because of the prevailing meteorological conditions, for it is said that the storms of winter and spring are almost invariably followed by calms, hence it is generally necessary to row the boats to the fishing grounds, whenever the weather permits the fishermen to work, and often the boat must be rowed back because of lack of wind or adverse winds. It will thus be seen why it has been so difficult to influence the fishermen regarding the shape of their boats, but the fact cited makes it still more inexplicable that no attempt has been made to lessen surface friction on the craft they now have, and thus to improve them materially in the matter of rowing.

The problem of designing an open boat that will safely encounter the most trying conditions met with in the pursuit of the winter cod fishery at Lofoten may possibly be beyond the skill of any designer, for storms arise with such suddenness and violence that it is impossible for the fisherman always to avoid being caught out in weather that

any small open boat could scarcely live through. Nevertheless, there are many reasons for believing that a boat of a better design, such, for instance, as that exhibited by Mr. J. A. Johnsen, fishery inspector at Bodo (Pl. XX), would safely and successfully ride out gales when the Nordland boat would be swamped, while, at the same time, it would have superior carrying capacity and be equally easy to row.

Whatever else may be said, it is evident that the Nordland boat, with its low freeboard and small capacity, is poorly adapted to carrying a cargo of fish in rough weather, for it sits so deep in the water when loaded that the waves will wash over it amidships.

Indeed, it is difficult to imagine how a boat of this size could be made less seaworthy. But it does not appear that Norwegian fishermen always depend on their boat taking them safely through rough weather, simply because of its seaworthiness or ability to ride safely over the waves. "When the crew see that there is no hope of keeping the boat afloat in the ordinary way," remarks Dunell, "they will purposely give her such a lurch, by a simultaneous movement of their bodies, that she will turn completely over, and the fish or ballast that may be on board will fall out, and the boat will float keel up through the natural buoyancy of the wood. Then the fishermen scramble onto the flat bottom, and by sticking their knives deep into the keel will try to hold on until the storm is past or they drift ashore, but their most frequent fate is to be washed off and swallowed by the sea. It is a common saying among the fishermen of these parts that two out of every three meet their death by drowning. It is said that the Norwegian fishermen on some parts of the coast consider a boat unsafe that can not be turned over by the movement of the crew on board; so that the low middle portion which we in England should consider so undesirable an element in the design is looked on by the native fishermen as a necessary feature." It is often the case that holes are cut in the bottom of the capsized boat to let the air beneath escape, thus rendering it steadier on the waves. "In this situation the crew will wait in hope of being saved by some other vessel," writes Ferguson, "a hope which is not always realized, as the yearly loss of lives in this part of Norway by boats being wrecked is over 180. Quite as many lives, however, are annually saved by being rescued from the keel of boats thus upturned."[1]

Fortunately, the presence of life-saving boats on the northern fishing grounds in recent years has been a potent factor in decreasing the loss of life, but the necessity for adopting an improved form of boat is still apparent. This is important enough to justify the remarks made here, in the hope that a satisfactory solution of the problem may soon be reached.

[1] Paris Universal Exposition, 1878. Reports of United States Commissioners. Pisciculture.—Thomas B. Ferguson.

Following are the dimensions of a Nordland boat the "Nordkap" exhibited at Bergen: Length over all, 21 feet; beam, 5 feet 1 inch; depth, 19 inches; height of mast, 14 feet.

The relative dimensions of one of the largest boats are as follows: Length over all, 39 feet 11 inches; beam, 10 feet 1 inch; depth, 3 feet 2 inches; height of washboard amidships, 9½ inches; mast above gunwale, 27 feet 10 inches; topsail yard, 11 feet; oars, 12 feet 1 inch.

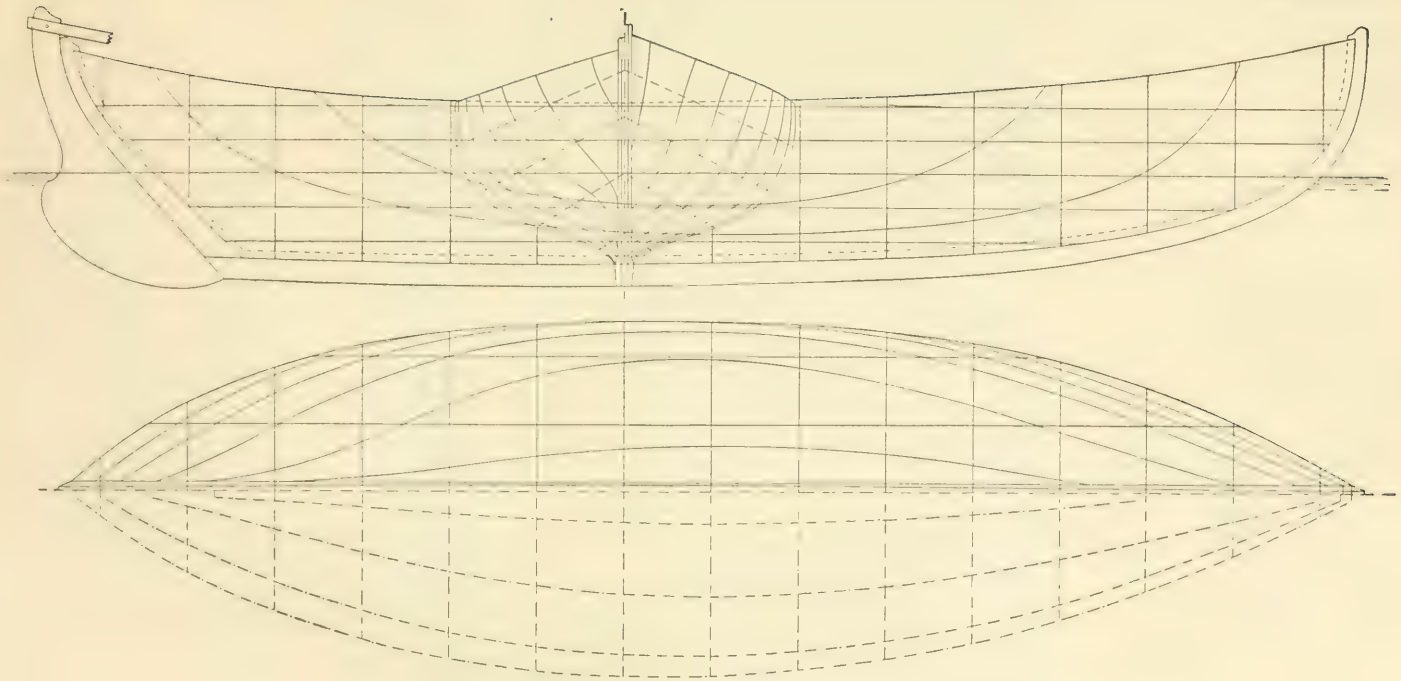
Suggested improvement in Nordland boat.—The improved form of boat for the Nordland fisheries designed by Fishery Inspector Johnsen deserves more than a passing mention. While it has a sharp stern and hollow floor, it will be seen that it differs radically from the typical Nordland boat (Pl. XX). Instead of the quick rise at bow and stern noticeable in the latter, the new design has a graceful and uniform sheer throughout, while the unsightly and worse than useless high stem and sternpost are dispensed with. There is a moderate overhang forward, with a long easy curve to the forefoot, thus dispensing with the superfluous deadwood and surface friction seen in the Nordland type, and producing nearly straight or easy convex water lines, which are much better adapted to speed than abrupt wave lines, while this form of boat is more buoyant, and is easier to turn and quicker in stays when under sail.

The form suggested is designed to secure a high degree of buoyancy, and consequent carrying capacity, with fine lines; in this respect it is immensely superior to the old-fashioned craft. The stern is also as well formed as the forward section. Indeed, it is difficult to point out just how this design of Mr. Johnsen's can be bettered, having in mind all the conditions necessary for consideration; and, even if prejudice and conservatism prevent its adoption, it is a satisfaction to know that one officially connected with the Norwegian fisheries has given sufficient thought to the subject to enable him to suggest an improvement in boat designing that should earn for him the commendation of all who have the welfare of the fisheries and fishermen at heart.

The model exhibited by Mr. Johnsen was designed for a boat 30 feet long, 7 feet 10 inches wide, and 3 feet 10 inches molded depth. It is evident, however, that boats of various sizes can be built substantially from the same lines, though of course the larger they are the less proportional width they usually have.

The Ranen fishing boat.—The boats built at Ranen (fig. 19) differ from the typical Nordland boat chiefly in having a more symmetrical sheer throughout and without an abrupt rise at the ends. Indeed it is said that a large number of the boats used in the Lofoten fisheries are built by the peasants of Ranen, and therefore the description given of one will apply nearly as well to the other.

Omitting mention of those peculiarities that are common to both, and which have been previously alluded to, the following details of



PLANS OF IMPROVED NORDLAND FISHING BOAT

Designed by J. A. Johnsen.

one of the Ranen boats may be given: It has five thwarts, the two after ones being placed pretty close together, one of them serving as a seat for the steersman; the stroke oarsman sits on the forward one The middle thwart is placed a little forward of amidships, and against the after edge of this the mast stands. The two forward thwarts are for the rowers. The forward thwart is adjustable, but the others are permanently fastened. The boat is provided with six oars, and when being propelled by them each one of the three men who row use two oars. The rowlocks are generally of the single-prong type, a form which has been quite universally adopted in Norway, and these are provided with leather beckets for holding the oars.

FIG. 19.—Ranen fishing boat.

"The rowlocks of all the Northland boats," says Boehmer, "from the most ancient to the present Norwegian fishing craft, exhibit the same general model, although they differ from one another in size and detail of work. In every case they are cut out of one piece of timber. * * *

"They are called 'Keiper,' and the same ('Keipr') is found in old Icelandic sagas (*Fornmanna Sögur*) and in the Snorre's Edda. The Keiper consists of a piece of wood fastened to the gunwale by wooden pegs in the Söndmöre boat, in the absence of a gunwale, they are fastened to the top plank by two iron nails bearing an oblique prolongation at

one end, and furnished with a loop of wicker-work rope or leather, through which the oar is passed, and which prevents its slipping out of the keip while rowing. These rowlocks are in Norway considered superior to ordinary tholes, being not so liable to break as the latter."[1]

On each side of the boat, extending nearly two-thirds of its length, in the middle, is a stout gunwale, and in rough weather, or when the boat is deeply loaded, a vertical washboard is placed above this, the board being about one-half the length of the boat.

The mast is supported on each side by three shrouds, and also by an adjustable backstay which sets up with a single purchase; a forestay extends from the masthead to the stem. The mast is supported also on the after side by the halliards, which reeve over a sheave at the masthead and make fast on the weather quarter near the boat's stern.

The sail is of the ordinary square form used on the Nordland boats, and is provided with reefs both at top and bottom. There are three cringles on each side, at the foot of the sail, but it has only one set of reef points on the lower part. The sail is provided with a bowline on each side, which is attached to a bridle on each leech that reeves through a fair-leader at the stem head, and, when sailing close hauled, the weather leech of the sail can be extended, so that it sets better than it otherwise would.

The boat has a much shorter sternpost than that of the typical Nordland craft, and is steered with an ordinary straight tiller that shoves into the rudder head and works over the top of the sternpost. For holding this tiller in any desired position there is a "tiller chock," a sort of elevated horse, which extends from side to side, is curved strongly, and has a large number of wooden pins in its upper side; when the helmsman wishes the boat to steer herself for a short period he drops the tiller into this chock between two of the upright pins, which prevent it from moving.

The boat is clinker-built, as is common with the small craft used in the northern fisheries; fastened with copper; has five strakes of plank on each side, and sixteen sets of timber. There is a heavy half keelson in the center of the boat, extending about two-fifths of her length. The middle portion of the interior is divided into two compartments by three bulkheads beneath the thwarts, and in these sections the fish and fishing apparatus are commonly stowed.

A craft of this kind may vary from 18 to 40 feet in length. The following are the principal dimensions of an eight-oared boat: Length over all, 26 feet; beam, 6 feet 2 inches; depth, amidships, 26 inches; depth of keel, 6 inches; mast, extreme length, 20 feet 6 inches; main yard, 9 feet 4 inches; sail, hoist, 12 feet; head, 9 feet; foot, 13 feet 6

[1] Proceedings of United States National Museum, 1886, pp. 443–444.

inches. A four-oared boat was 18 feet 4 inches long, 4 feet 7 inches wide, and 21 inches deep.

Finmarken fishing boat. The open boat chiefly used in the fisheries from the coast of Finmarken, and especially in the cod fishery (fig. 20), has been copied from the Nordland boats; indeed, many of the latter go to Finmarken in the spring or early summer to engage in the great "lodde" cod fishery. The boat referred to here under the above caption is, however, that which has been built at Finmarken; this, though a copy, is sufficiently differentiated, according to reliable authority and models, to be considered largely typical.

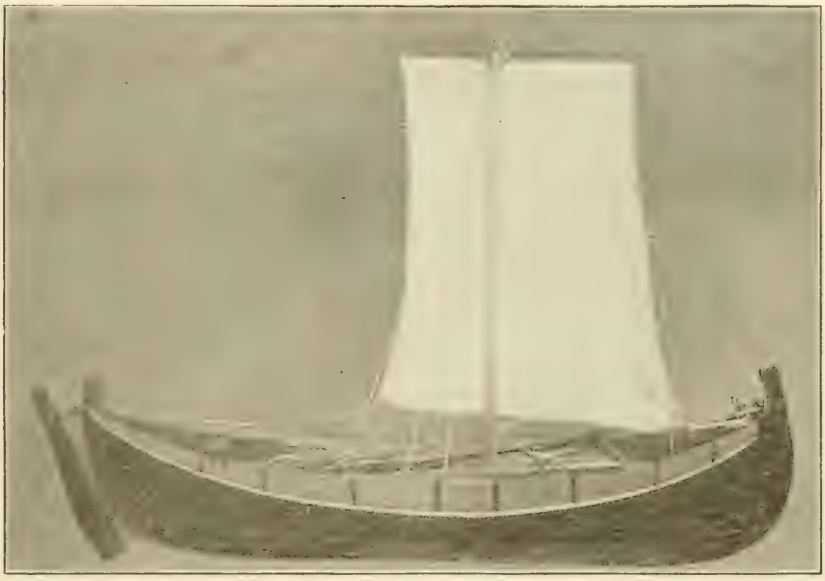


FIG. 20.—Finmarken fishing boat.

It is wider and deeper than the Nordland boat, the extra depth being due to a wide plank put on permanently above the gunwale and extending from bow to stern, the ends being much narrower than the center. The sheer is more like that of the Ranen boat, but, according to a model, the upper end of the stem curves inboard, the mast stands farther forward, is comparatively short, and the sail is much smaller than is common on the west coast of Norway.

It is an open, double-ended, clinker-built, keel boat, with curved stem and sternpost; typical Norwegian rudder and hinged tiller.

Following are the dimensions of a Finmarken fishing boat: Length over all, 22 feet 11 inches; beam, 7 feet 11 inches; depth, 25 inches; mast, above gunwale, 14 feet 2 inches; yard, 11 feet 8 inches; oars, 12 feet 6 inches.

The Söndmöre fishing boat.—A type of boat commonly used in the cod and herring fisheries at Söndmöre (fig. 21) differs materially in shape, construction, and rig from other Norwegian craft.

In the models exhibited, certain differences were noticeable; these, however, were probably due to the individual fancies of the builders. Although there may be some slight variations in the form and construction, the type is nevertheless well defined. I am informed, however, that it is being superseded by other kinds of boats, and is less numerous than formerly, although still a well-recognized form in the fisheries.

The shape of the Söndmöre boat is peculiar, resembling somewhat the half of a pea pod which has been cut in two horizontally, and has

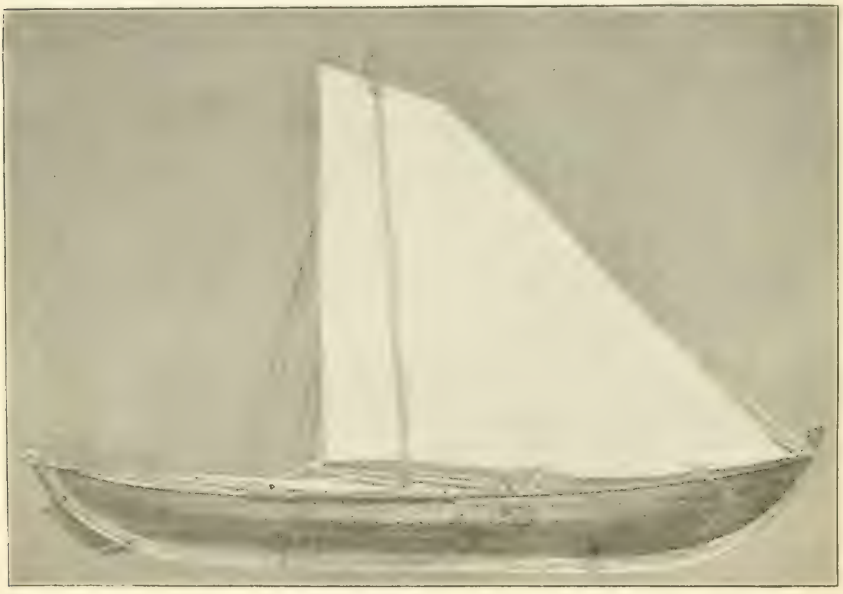


FIG. 21.—Söndmöre fishing boat.

been very much spread out in the middle. It has sharp flaring ends with generally convex lines, and is somewhat wider and fuller forward than aft. There is a supplementary top strake at the bow which extends aft a little more than one-third of the boat's length, and another at the stern which is about half as long.

These additional streaks raise the bow and stern considerably above the midship section, and give the boat the appearance of having a strong sheer. It is wide, but comparatively shallow; it has a deep keel; the stem and sternpost are wide, with a long slanting curve, and extend from 1 to 3 feet above the top strake. It is V-shaped throughout its entire length; and the upper part is spread out very broadly, so that the sides have a strong flare. The floor near the keel is slightly

concave, but from that point nearly to the top of the upper strake there is comparatively little convexity in the low midship section.

It has nearly a minimum superfluous surface friction, and with the flaring top side it gets a strong "shoulder" and rapidly increases its stability when heeling to a breeze; therefore, for rowing or sailing in moderate winds and fairly smooth water, the form is an excellent one. The short keel and "rockered" ends facilitate quick turning.

The Söndmöre boat is entirely open and clinker built, but in some respects its construction is very unique. The model referred to has nine sets of timbers and half frames; also a breasthook at each end which is placed in a diagonal position, its apex being low down in the boat and its arms extending toward the upper streak. Running along each side of the interior at the floor timber heads (or at the upper edge of the second strake from the top) is a heavy clamp or thick streak about two-thirds of the boat's length in the middle; it approaches the stern somewhat nearer than it does the bow. It is held in place chiefly by top timbers or stanchions, the lower ends of which are notched so as to fit over the clamps, and it is additionally secured by being nailed to the outside planks. Two stout beams extend from side to side of the boat, their ends resting against the planks and the clamps. One of these beams is about in the middle of the boat and the other is from 2 to 3 feet farther forward. Each of these is covered by a thwart; there are six thwarts in all. The boat is not ceiled inside, but it has narrow, adjustable platforms which are placed between the frames, low down in the bottom.

It has four streaks of plank on each side amidships and six streaks at the bow. The distinguishing characteristic of this craft is that it has no gunwale, and the lower bow planks instead of being placed in the usual way, horizontally or sloping downward beneath the bilge, extend diagonally upward at an angle of 10° or 15°, and meet the other planks coming from the stern about one-third of the boat's length from the stem. The ends of the planks are chamfered, so that they lap over the after planks instead of butting against them. This form of construction, it is claimed, while being quite as strong as any other, gives great elasticity to the boat and not only renders her safer in a sea way but makes her much easier to row and swifter under sail.

Writing of this peculiar construction, Dunnell says:

> There is another curious theory raised by the Norwegian fishermen which has led to the strakes in the fore part of some classes of boats being placed diagonally instead of fore and aft to the keel, and consequently out of line with the planking of the midship and after parts. It is stated that this is done in order to allow the boats to free themselves from water, supposing a heavy sea should break on board. Although the idea may seem absurd at first glance to those accustomed to a more rigid construction of vessel, there is no doubt that the theory appears far more plausible when one comes to consider the matter. The boat in its midship section is very shallow, and the sides are not high. There is, therefore, no rigid double web, as it were, to resist the bending strain. As the boats ride on the water they tend to conform to

the contour of the waves when there is a great weight of water on board. In this way the water would run out at the ends when the boat was poised on the wave crest, and in like manner would flow out over the low sides amidships when in a hollow. Whether this theory be sound or not we will not venture to pass an opinion, but it may be not altogether impossible that the fishermen have good reason for adopting it, extravagant as it may appear at first sight.

Having had a long practical experience in open boats in varying kinds of weather, I am inclined to be somewhat skeptical about this form of construction having so many advantages as are claimed for it, though its elasticity doubtless aids it in sailing and rowing. One thing, however, is pretty sure to happen to almost any open boat that is filled with water and which is partly or wholly loaded with fish. It will capsize at once, especially in rough water, unless, indeed, it should be ballasted with rocks, sand, or shingle, in which case it will sink.

When engaged in the gill-net fishery, the Söndmöre boat, like other Norwegian craft, is provided with an adjustable roller, over which the nets are pulled. This may be put on any part of the boat's side.

The rudder is usually small, curved on the fore side to fit to the sternpost, and is operated with a tiller similar in form to that used on the Nordland fishing boat. The rowlocks are also of the single-pronged type commonly used in northern Norway.

The boats of Söndmöre are usually built of pine, or planked with it, and when they are well cared for it is said that they last a long time.

The rig differs somewhat from that of the Nordland fishing boats. A single raking mast stands amidships, and this is supported on each side by four shrouds, to the lower ends of which are attached pointed wooden toggles. In each of the side clamps that have previously been mentioned are four metal staples, into each of which is spliced a rope becket. The toggles on the lower end of the shrouds are inserted in these beckets when the mast is erected. This is a convenient arrangement, for the standing rigging can almost instantly be removed or put in place whenever it is desirable to lower or erect the mast. The mast is sometimes, though not always, additionally supported by a stay running to the stem head.

A narrow-headed lug sail is carried, which, when the boat is sailing close hauled, tacks down to the stem, while the sheet trims to the lee quarter. The larger part of the sail, however, when trimmed in this manner, is forward of the mast, and the center of effort of the sail is considerably forward of the midship section. In case there is a forestay, it is customary to lace the lower part of the sail to it when the boat is by the wind; but when there is no stay, a rope is rove through the cringles in the luff of the sail and taken around the stem head. The sail of the Söndmöre boat is peculiar to it, and this special form of lug-sail, it is said, makes it easy for the boat to go very close to the wind.

A boat like this will carry a crew of eight men, one of whom is usually employed in bailing out the water that comes into her.

The boats from Söndmöre vary considerably in size. Two full-size six-oared boats which were exhibited from there were 24 and 27 feet long, respectively. Following are the dimensions of the latter: Length, over all, 27 feet; beam, 6 feet; depth, 2 feet; mast, extreme length, 26 feet 9 inches; oars, 12 feet 5 inches.

Banker's trawl-line boat.—The vessels employed in the Storeggen Bank fishery in summer, and at other seasons in the market fishery, from Cape Stadt to Christiansund, usually carry from two to three large sail boats for setting and hauling trawl lines.

FIG. 22.—Banker's trawl-line boat.

The typical boat used for this purpose (fig. 22) is a clinker-built, sharp-ended, keel craft. It is entirely open, wide and deep; therefore bulky and heavy for handling and hoisting to and from the deck of a vessel. It is rather full on top at the ends, but has moderately easy lines below. It is fitted with two masts and carries two loose-footed sprit sails; the mainsail is much larger than the foresail. The foremast is stepped just abaft the stem, and the mainmast is forward of amidships. It has a line-roller at the stem, and is usually equipped with an iron winch for heaving in the trawl lines. This winch is placed on the forward thwarts. There are five thwarts, in one of which the mainmast is stepped.

Boats of this type usually sail to and from the vessel, if there is sufficient wind: when the trawls are hauled the sails are furled and the masts unshipped. Three or four men are required for a crew.

The following are the relative dimensions of a boat of this type: Length over all, 22 feet 1 inch; beam, 8 feet 9 inches; depth, gunwale to garboard, 3 feet 9 inches; foremast above gunwale, 13 feet 4 inches; average width of foresail, 6 feet 3 inches; average width of mainsail, 6 feet; length of oars, 14 feet, 16 feet, 17 feet 6 inches.

Norwegian dories.—While some of the dories built for prosecuting the deep-sea trawl-line fisheries from Norway are fairly close copies of the American fishing dory, most of the boats of this type, particularly those used from steam liners, are wider and deeper than those built in the United States and are also heavier in construction. They look heavy, clumsy, and unwieldy in comparison with American-built dories, and most of them are not adapted to rowing to windward against a fresh wind and choppy sea.

The reason for this form is because, when fishing off the coast, it is considered important that a dory should be able to carry her day's catch, so that it will not be necessary in the short days of winter or spring for her to go alongside the steamer to discharge her fish before the lines are all in. The matter of having a good rowing dory is deemed of secondary importance, for the steamers pick up their boats and the fishermen seldom have to row much except when setting the lines, and then generally before the wind.

Two full-size dories were exhibited, neither of which would be considered a good example of the American type of this kind of fishing boat. One was from Trondhjem and the other from Arendal. The former had four streaks on a side and, in this particular, resembled the four-streaked dories formerly built by a firm in Gloucester, Mass., but which are now practically obsolete, while the three-streaked Salisbury dory still remains the American type. The Trondhjem dory was 19 feet 7 inches long, 5 feet 2 inches wide, and 21 inches deep.

The Arendal dory was much wider and deeper, and had a heavy chafing (quarter-round) streak outside the gunwale from stem to stern. This boat was 20 feet long, 5 feet 11 inches wide—bottom, 3 feet 1 inch wide—and 26 inches deep.

Sognefjord fishing boat. The typical fishing boat of the Sognefjord district, of which a full-size specimen was exhibited, is an open, clinker-built, sharp-ended, keel boat, with curved raking stem and sternpost; concave water lines; rising floor, and moderately flaring sides. It ranges from 17 to 30 feet in length, but boats not exceeding 22 feet in length are, perhaps, most in use.

It has four streaks on a side, and three frames occupying from one-quarter to three-eighths of a boat's length in the center; the two forward frames have crossbeams, like the four-oared boat, hereafter to

be described. There is a breasthook at the bow and stern; in each case this is placed diagonally, with the arms slanting upward, to secure greater strength. It has four rowlocks of the ordinary L-shaped pattern, usually with wickerwork beckets to hold the oars.

It has no gunwales, the upper strake, which is 10 or 12 inches wide in the middle and 2 or 3 inches wide at the ends, has no support of this kind. Instead of this there is on each side a ribband or clamp running along the inner upper edge of the strake next the top, between the breasthooks, and this serves to stiffen the boat somewhat, which seems necessary in the absence of gunwales or ceiling. Boards are laid along the bottom for the oarsmen's feet to rest on. Boats of this type seen in Sognefjord were not painted, but were covered with a sort of varnish. The oars are of the conventional form.

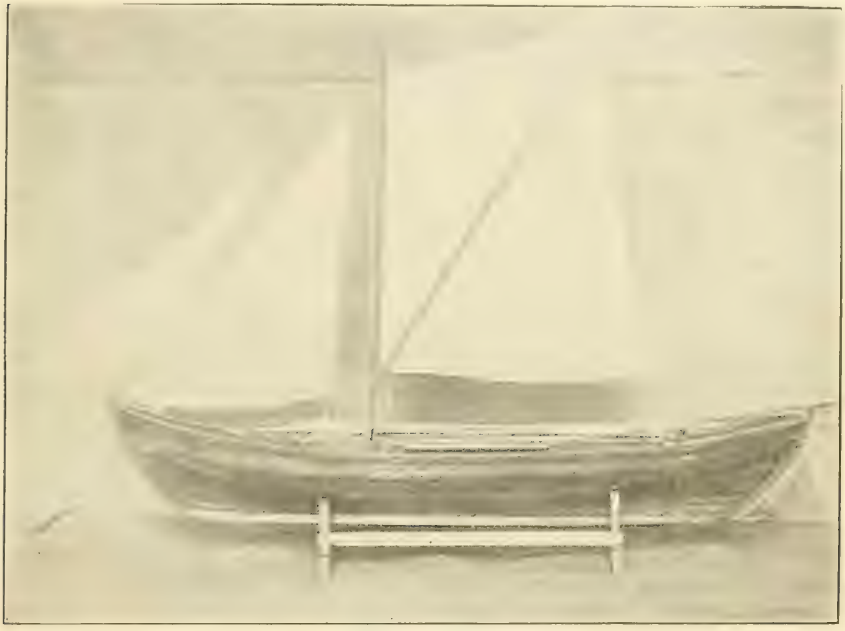


FIG. 23.—Bergen herring boat.

The rig usually consists of a narrow-headed and rather small square sail, set on a mast stepped nearly amidships.

One of the boats had the following dimensions: Length over all, 22 feet 7 inches; beam, 5 feet 3 inches; depth, 22 inches, stem and sternpost 10 inches above upper streak; oars, 10 feet 9 inches long.

Bergen or Sondhorland herring boat.—A large fleet of boats is employed in the herring fishery from Bergen and vicinity, and are represented in the spring herring fishery which is prosecuted from the coast fishery stations south of Bergen.

The typical boat of this class (fig. 23) is an open, clinker-built, sharp-ended, keel craft, with raking curved stem and sternpost; hollow floor

and water lines; bow rather full above water; good sheer; three thwarts forward of mast and two well aft; a large open space is left between the forward and after thwarts for the storage of gill nets. A net roller is fitted on the side.

It has a single mast, a loose-footed sprit-mainsail, stay foresail tacking to stem head, and a small jib set flying on an adjustable bowsprit.

The following are the dimensions of a boat of about the average size: Length over all, 27 feet 6 inches; beam, 8 feet; depth, 2 feet 3 inches; mast, above gunwale, 15 feet; oars, 15 feet long.

Four-oared fishing boat.—Among the small, open fishing boats of Norway, none is more worthy of notice than the so-called four-oared boat, which is in well-deserved favor along a considerable section of the coast, including that from just north of Bergen through the Hardanger Fjord.

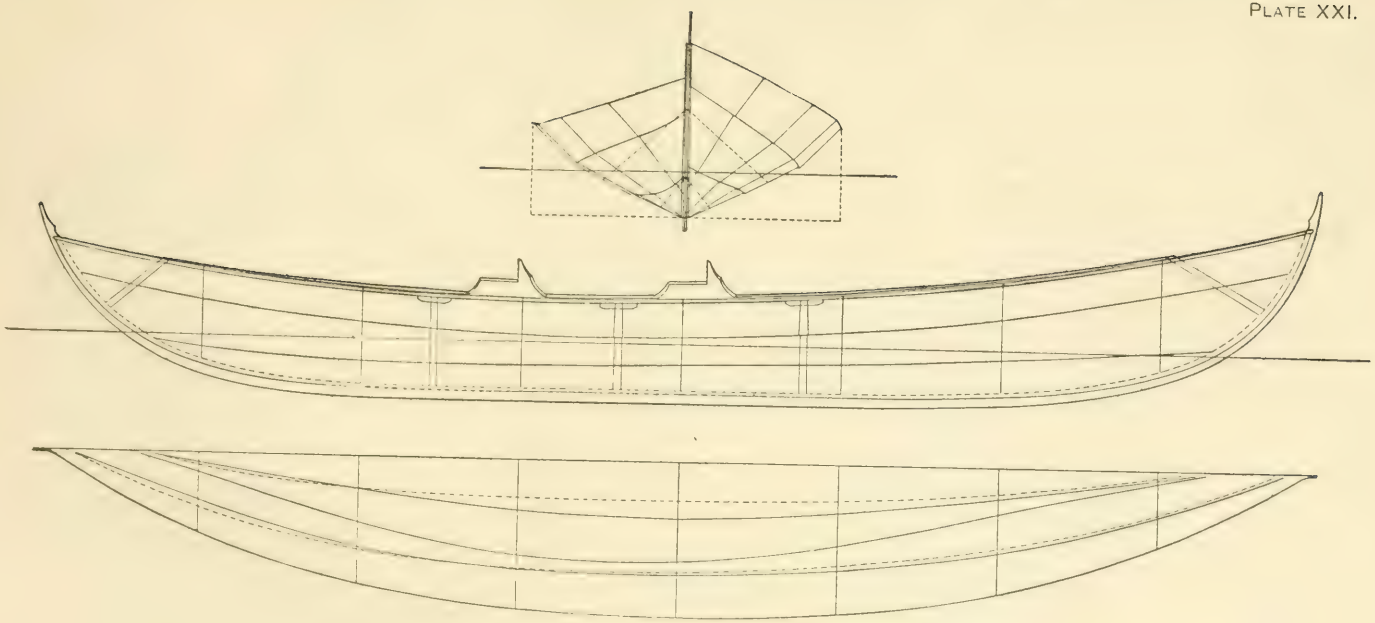
The southwest coast of Norway, from Bergen to the Naze, is much cut up with fjords and estuaries, and to a fishing population, such as inhabits this region, a light row boat is so indispensable that it is stated that "the poorest people, even beggars, possess such boats in this part of Norway."

Probably no other type of Norwegian boat embodies so many good qualities as this, or is so well adapted to the purposes for which it is used, and the wonder is that larger boats are not built substantially on the same lines.

It is used for various purposes besides fishing, and is one of the most popular rowboats in the country. Numerous full-size boats of this type were exhibited. Most of these were of the ordinary construction, but some, designed for pleasure rowing, were more highly specialized, and constructed so as to bring out the best points of this form. The most notable exhibit of this kind was a full-size boat, designed and built by Olaf T. Olsen, of Bergen, the plans of which are shown in Plate XXI. This boat is 19 feet 6½ inches long, 4 feet 9¾ inches wide, and 17¼ inches deep.

Although it is built somewhat crudely, as a rule, the four-oared boat embodies the elements of speed in a high degree; therefore it rows and sails well. One which I saw at Bergen was fitted up as a small yacht. It was decked, with the exception of a small cockpit amidships, sloop-rigged, and provided with a fish-shaped lead bulb on a fin keel, like some of the small racing boats in the United States. This little craft, not exceeding 18 feet in length, was very swift, quick in stays, stiff, and possessed the qualities most desired in a small, canoe-shaped racing boat.

The size is usually from 16 to 20 feet in length, and for fishing purposes it is always an open, clinker-built, sharp-ended, keel boat; with curved, rather strongly raking stem and sternpost; usually straight or



PLANS OF FOUR-OARED BOAT.

Designed by Olaf J. Olsen.

slightly convex water lines; sharp floor; easy round bilge, and flaring sides and ends. It has a medium sheer; low, pointed stem and sternpost; three thwarts; two rowlocks on a side, and two pairs of oars. The rowlocks are of the ordinary Norwegian form, with beckets of twisted withes for holding the oars. There are three streaks of plank on a side.

These boats are built chiefly of pine, and very little metal fastening is used in construction. One which I saw in course of construction in Hardanger had no metal fastening in the frames, small, wooden treenails being used instead of nails. The three floor frames came nearly to the top of the streak next the top one. Crossing from side to side, over each of the two forward frames, was a pine knee, the short arm of which extended upward to the gunwale on one side, while the longer arm served as a beam to strengthen the boat and to support the thwart. To the other end of this beam was fastened (with treenails) a shorter-armed knee, one prong of which fitted to the boat's side up to the gunwale. The whole, in each case, was fastened to the planks and frame. There are only three frames occupying about one-third the boat's length amidships, but at each end is a stout breasthook, placed diagonally and reaching up to the gunwale on each side.

A feature of the construction is that often, if not always, the frames are put in after a boat is planked and the planks fastened together. This was the case with the one I saw building. The bow and stern planks, as well as the stem and sternpost, were held in position by numerous braces, the upper ends of which fitted into the longitudinal grooves (of which there were three) of an overhead beam, while the lower ends rested against the various parts of the boat.

The fishing boats are for the most part built by those who use them. They are, however, inexpensive, for a four-oared boat with its equipment of oars can be bought for from $10 to $12.

The rig consists of a loose-footed sprit-mainsail, and jib tacking to stem head.

The following dimensions of a full-size Hardanger boat are about the average: Length over all, 17 feet 10 inches; beam, 5 feet; depth, 19 inches; oars, 10 feet 7 inches long.

Stavanger herring boat.—This type of boat (fig. 24) is from 30 to 40 feet long and is very extensively used from Stavanger to Bergen, particularly in the spring herring fishery at and near Hagesund. It is swift and seaworthy, and is undoubtedly one of the best open boats in Norway. A boat of this class took first prize in the fishermen's regatta off Bergen July 12, 1898. A herring boat is equipped with from 25 to 30 nets, each 15 fathoms long, but it is customary to use only about 12 nets at a time, these being anchored near the land.

It is an open, sharp-ended, clinker-built, wide boat, with keel; mod-

erately raking, curved stem and sternpost; hollow floor and water-line; symmetrical sheer; nearly horizontal washboards along the sides, with coamings on their inner edges; four narrow thwarts, and eight oars.

It has a single mast and cutter rig, with a loose-footed sprit-mainsail, stay foresail, jib set flying from an adjustable bowsprit, and a club-headed topsail set on a long pole that comes down within easy reach, its heel stepping into an eyebolt on the forward side of the mast. The mainsheet works from side to side on a traveler.

FIG. 24.—Stavanger herring boat.

Following are the dimensions: Length over all, 30 feet; beam, 10 feet 5 inches; depth, 4 feet 7 inches; mast, above gunwale, 21 feet 3 inches; bowsprit, outboard, 8 feet 9 inches; gaff-topsail pole, 24 feet 2 inches; oars, 20 feet long; net roller, 3 feet 11 inches long.

Stavanger six-oared fishing boat.—This is similar in form and rig to the Stavanger herring boat, but smaller, being about 20 feet long and rigged with jib and sprit-mainsail. It is used for hand-line and long-line fishing in the sounds and fjords, and 4 or 5 miles off the coast.

Its crew usually consists of three men, who operate from 500 to 1,000 fathoms of line.

Stavanger welled fishing boat.—A sharp-ended, clinker-built, open boat, fitted with a well in the after section to keep fish alive, is used in the coast fisheries at Stavanger (fig. 25). It has the usual curved stem and sternpost, three streaks of planks on a side, a good sheer, and three thwarts. The well is covered, and the tiller is long enough to reach over it, so that it can be grasped by the boatman.

A sloop rig is common, with a loose-footed spritsail, and jib tacking to stem head.

The dimensions are: Length over all, 21 feet 8 inches; beam, 6 feet 8 inches; depth, 3 feet; well, 4 feet 2 inches long; mast, above gunwale, 13 feet 4 inches; oars, 12 feet 6 inches.

FIG. 25.—Stavanger welled boat.

Hardanger seine boat. This type of boat (fig. 26), which differs from any other in Norway, derives its specific name from the fact that it is built chiefly in the Hardanger province, for operating drag seines in the herring fishery. It is nevertheless employed along an extensive stretch of the Norwegian coast, since the seine fishermen change from point to point, their movements corresponding with the appearance of fish in different places.

The boat is designed for the sole purpose of making it specially fitted

to the purpose of carrying and operating the heavy herring seines in common use.

It is rather large, and, being wide and deep, looks clumsy. It is an open, clinker-built, keel boat, with sharp moderately flaring bow; rising floor; easy run, and square stern without overhang, the rudder being outside, and the tiller passing through a slot in the upper part of the stern.

It is cutter rigged; the mast stands about two-fifths of the boat's length from the bow, and on it are set a loose-footed gaff-mainsail;

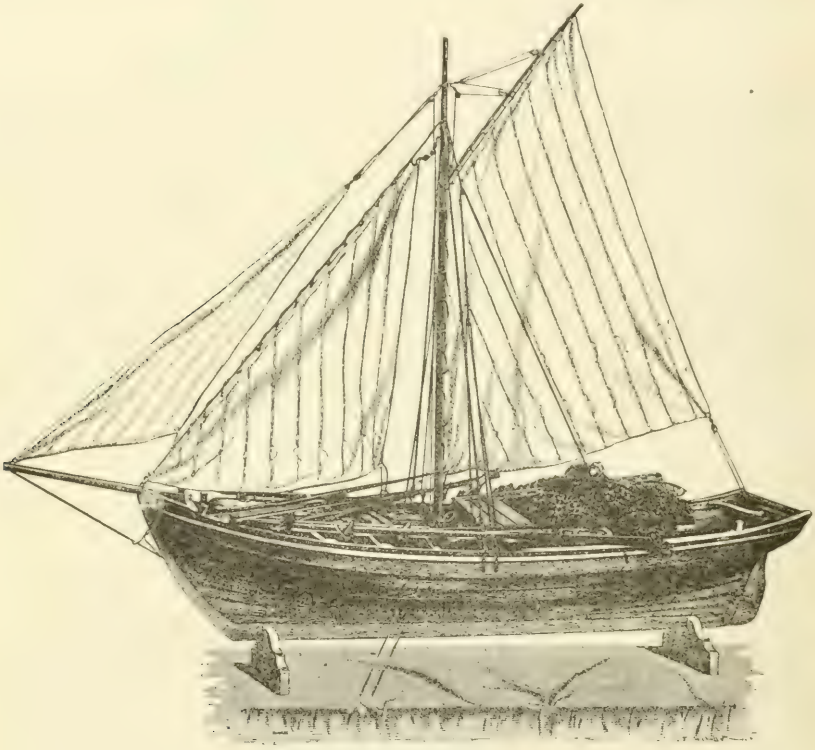


FIG. 26.—Hardanger seine boat.

stay foresail, and small jib set flying on a short adjustable bowsprit. The main sheet trims to an iron traveler which extends across the stern.

Its chief peculiarity is the movable deck in sections, which covers the seine abaft the mast for a little more then one-third the boat's length, and has a slight pitch to shed water, something like the roof of a house. This deck is for the protection of the seine when the latter is not required for immediate use, but of course the covering is removed at other times.

A wooden roller extends across the stern, and the seine passes over this, when it is set or hauled in, instead of over the side, as gill nets do. Forward and aft of the space occupied by the net is a primitive wind-

lass used in working the seine. Forward of the mast there are four rowlocks on a side and four pairs of oars are carried.

Following are the dimensions of one of these boats: Length over all, 32 feet 7 inches; beam, 10 feet; depth, 4 feet 8 inches; mast, above gunwale, 23 feet 4 inches; gaff, 11 feet 3 inches; bowsprit, outboard, 6 feet 3 inches; oars, 16 to 20 feet long.

Hardanger gill-net boat.—This style of boat (fig. 27) is extensively employed in the gill-net herring fishery, especially the spring herring fishery, in the prosecution of which the province of Hardanger takes a most conspicuous and active part. Between January and April, when the herring fishery along the southwest coast of Norway is at

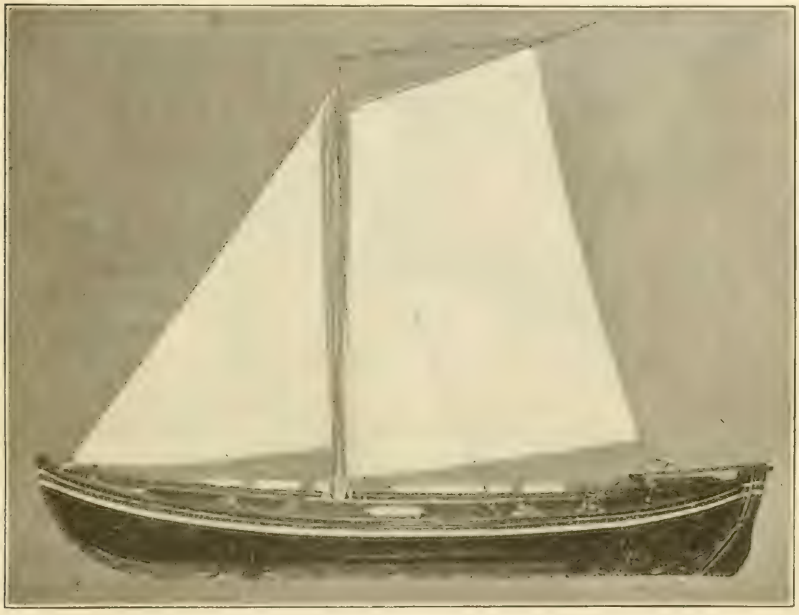


FIG. 27.—Hardanger gill net boat.

its height, thousands of gill-net boats are gathered at the chief fishing stations; among these the Hardanger boat is prominent.

It is very similar to the herring boats from Bergen and Stavanger, being, like them, a sharp-ended, clinker-built, keel boat, with curved raking stem and sternpost, but still differing in some particulars. It has washboards along the sides from stem to stern, these being provided along their inner edges with high coamings except at the bow. The net roller is fixed on top of one of the washboards. The boat studied had an iron mainsheet traveler crossing from side to side near the stern, and curved to admit of the tiller working under it. Forward of the traveler was a tiller chock, from side to side, with pins for holding the tiller steady when necessary.

It has a sloop rig; the mast is only a little forward of amidships,

and on it are set a loose-footed gaff-mainsail, which is laced to the mast, and jib on a stay that sets up inside of and below the stem head. There are eight oars and four rowlocks on a side, two of the latter being forward of the mast and two well aft. The nets and fish are put into the so-called fish rooms amidships.

The dimensions are: Length, over all, 25 feet 4 inches; beam, 8 feet 9 inches; depth, 3 feet 3 inches.

Hvidingsø fishing boat.—A new style of boat has been introduced at Hvidingsø in recent years and has been employed in the great spring herring fishery at this place. By many this is considered one of the very best open fishing boats in Norway, and it undoubtedly has many fine qualities. It resembles the Lister mackerel boat in some respects, but is a better form. It should be swift and powerful under sail, seaworthy, and fairly easy to row, though it can scarcely be expected to rival the narrower Nordland boats in the latter qualification.

In many respects it has the well-known features common to Norwegian fishing boats. It is an open, clinker-built, sharp-ended keel boat, with hollow floor and water lines; curved raking stem and sternpost, and moderate sheer. It has five thwarts, the after one being the helmsman's seat. A washboard 3 inches wide, with a coaming three-fourths of an inch high, extends from stem to stern on each side. The boat examined was not ceiled, and I understand it was a fair representative of the type. It was, however, fitted with a most excellent apparatus for distributing oil and smoothing the sea during strong winds, a device which I believe is not commonly used, although its efficiency is so evident that its adoption by American fishermen may justly be urged. It was placed under the forward thwart, and consisted of a semi-circular tin oil can 16 inches long, 7½ inches deep, and 6 inches wide, fore and aft. In shape and size it resembled half a cheese. It was arranged so that it could be filled through the thwart by loosening a screw, and was provided with two lead pipes from each side of the lower part of the can, which passed through the boat's bottom and were controlled by stopcocks, so that oil could be let out to any extent required in rough water.

The sloop rig is preferred, with loose-footed sprit-mainsail, and jib tacking to stem head.

Following are the relative dimensions: Length over all, 25 feet 2 inches; beam, 7 feet 8 inches; depth, 2 feet 11 inches; mast, above thwart, 13 feet 6 inches; stem to mast, 8 feet 6 inches.

Lister fishing boat.—This boat is used in the fisheries, and particularly in the drift-net mackerel fishery, along a considerable stretch of coast in southwestern Norway. It originated in the province of Lister, and because it was formerly built with particular reference to the mackerel fishery, it has generally been called the "Lister mackerel boat" (fig 28). It is noted for the uniformity of its shape, construc-

tion, and rig, and it is said to be difficult to tell one of these boats from another.

The Lister boat is sharp aft, has water lines very much concaved, hollow floor, and deep keel. It is clinker-built; has usually about six frames, and a breasthook at each end; the stem is curved and has a moderate rake; sternpost slightly curved; rudder, hung outside; washboards or runways along the sides from stem to stern, and five thwarts, through one of which—the second from the bow—the mast steps.

It has a cutter rig; the mast is about one-third the boat's length from the bow, and on this is set a loose-footed sprit-mainsail, stay forsail tacking to stem head, and jib set flying on an adjustable bow-

FIG. 28.—Lister fishing boat.

sprit, which passes through an iron ring on the starboard side of the stem; the heel of the bowsprit is held in a wooden bar that crosses the boat's bow.

The Lister boat has much initial stability, and will carry sail well with a comparatively small amount of ballast; it is swift in most chances. But it seems rather questionable, at least, that the extremely hollow lines would permit of its sailing exceptionally fast in rough water. The fact that it has recently been superseded to a considerable extent in the mackerel fishery by a different type of decked boat, which, though no larger, is better adapted to the work it has to do, proves that for deep-sea fishing other forms may be superior.

The dimensions of one of the largest are as follows: Length over

all, 40 feet; on keel, 30 feet 2⅜ inches; beam, extreme, 15 feet 1⅓ inches; depth amidships, 4 feet 8 inches; depth of keel, 10⅜ inches; height of mast above thwart, 30 feet 8 inches; total length of bowsprit, 16 feet; outside stem, 9 feet 9½ inches. Sails: Mainsail, luff, 24 feet, head, 14 feet 2⅜ inches, foot, 16 feet 4 inches, leech, 28 feet 5⅛ inches; main jib or fore staysail, luff, 26 feet 2⅜ inches, leech, 22 feet 8 inches, foot, 14 feet 8 inches; jib, luff, 24 feet 10⅜ inches, leech, 19 feet 1⅓ inches, foot, 12 feet.

Arendal seine boat.—A full size five-oared seine boat from Arendal was wide and deep, and very heavy in construction.

It was an open, sharp-ended, clinker-built boat, with full, round sides, and less rise to floor than most Norwegian fishing boats. It had

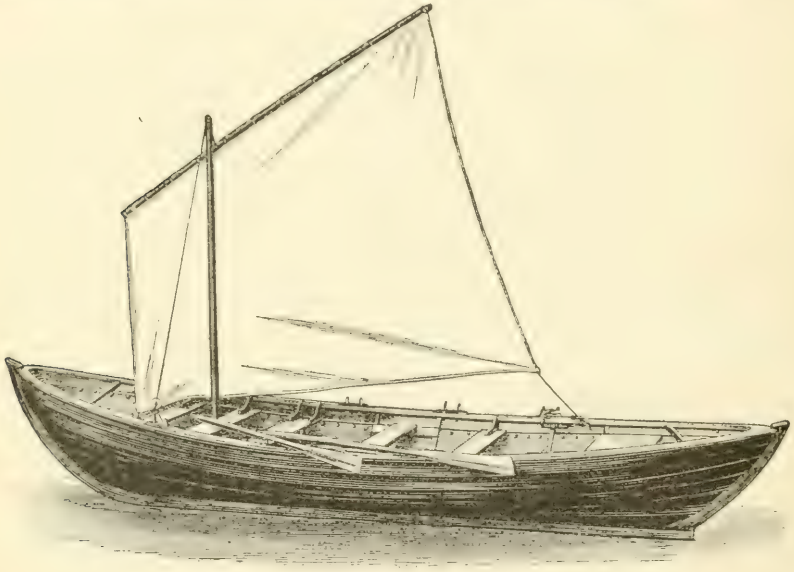


FIG. 29.—Arendal six-oared fishing boat.

washboards along the sides, these being one foot wide amidships, but tapering to a point at bow and stern. It was not fitted with a sail.

The dimensions were: Length over all, 20 feet 10 inches; beam, 7 feet 10 inches; depth, 3 feet 3 inches.

Arendal six-oared fishing boat.—The six-oared boat of Arendal, in southern Norway, is very similar in form and construction to the four-oared boat already described. It is usually provided with three pairs of oars, hence its specific name. It also generally has a small lugsail, though the spritsail rig is now growing in favor among Norwegians.

The dimensions of one of these boats are: Length over all, 19 feet; beam, 5 feet; depth, 15 inches. The seven-oared boat differs only in size.

Fishing praam.—The praam (fig. 30) is used to some extent in the fisheries of southeastern Norway, but rarely, if ever, on the west coast, where it is considered unsuitable for a fishing boat.

It is an odd-shaped, open, clinker-built boat, with a round bottom and a long scoop-shaped bow, which is square and narrow at the extremity and nearly heart-shaped in cross section. The keel follows the upward curve of the bow and protects the planks when the boat is beached. It has no run, but the square stern is somewhat smaller than the midship section, and there is usually a small skag aft. It has four thwarts and a stern seat. The praams used for fishing generally have a small mast stepped in the second thwart from the bow, and on

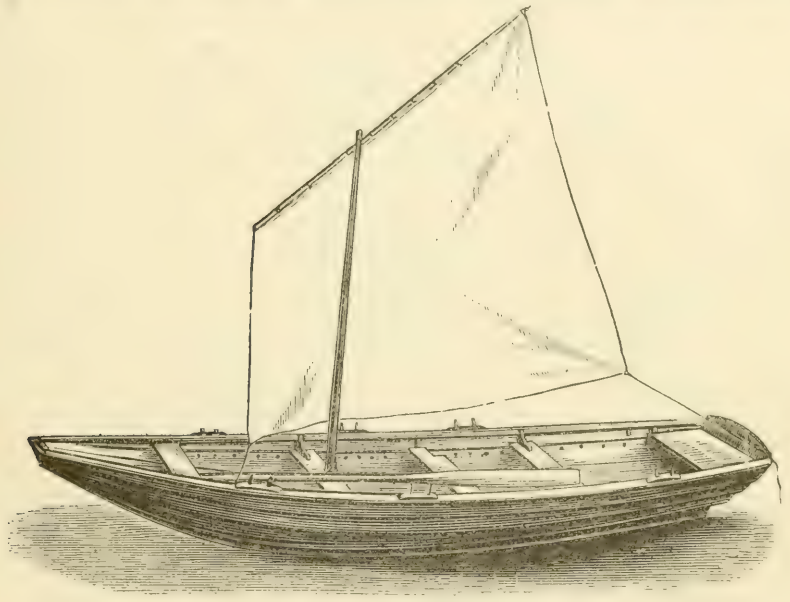


FIG. 30.—Fishing praam.

this is set a lugsail. One of these boats was 17 feet long, 5 feet 3 inches wide, and 19½ inches deep.

Norwegian life-saving boats.—Inasmuch as the sailing lifeboats of Norway were designed with special reference to saving the lives of imperiled fishermen, and assisting them to reach safety in gales by towing their boats to shelter, it seems appropriate that mention should be made of them here. Of all the attempts made to benefit the Norwegian fisheries, nothing has been done within the present century deserving of greater commendation than the introduction of these life-saving boats, and perhaps nothing has been more helpful. Eleven of them lay moored to the piers in front of the exhibition grounds throughout the summer. These boats vary somewhat in form, the earlier ones being sharper than those built at a later date. The three

boats first built were designed in imitation of the typical Norwegian-built pilot boats, and were rigged like the latter—having one mast stepped about two-fifths the boat's length from the stem, a running bowsprit, double head rig, a short main boom, and long gaff. The lifeboats most recently built have a yawl rig (Pl. XXII), higher free board, and fuller lines than their predecessors. They also have a winch windlass abaft the mainmast. They have flush decks, with low open rails extending from about 4 or 5 feet aft of the stem to abaft the mizzen rigging. The under-deck accommodations for cooking, sleeping, etc., of the larger boats are ample and comfortable.

These boats are sturdy seagoing craft, designed especially for working in strong winds and a heavy tumble of a sea. Their area of canvas is, therefore, rather small, and they are not intended to attain high speed in ordinary winds. It is evident that they must be out in the severest weather, and in sharp high seas; consequently they have a high degree of buoyancy, seaworthiness, and stability, so that they can live under the worst conditions and render assistance to fishing boats that are unable to gain the land unaided, or rescue men from the the bottoms of capsized boats.

Their work is various, although perhaps they are most frequently called upon to perform the duty of towing to windward fishing boats which are in danger of being blown off the coast or stranded upon some dangerous shore to leeward, which is not infrequently the case. One of these lifeboats will if necessary pick up and tow into port four or five fishing boats which otherwise would drift helplessly away to destruction.

In case a vessel is stranded, and her crew can not be rescued from the land, the lifeboat is maneuvered until she is in a position nearly dead to windward of the wreck. A line is then shot over the wreck and a larger line is drawn on board and fastened so that the ordinary apparatus for transferring people from stranded vessels to shore is used, and the crew are brought on board of the life-saving boat. The life-saving service of Norway, for which these boats are built, and which was instituted in 1890 for the special benefit of the fisheries, began in 1893 with one single-masted cutter. Two boats were, however, built that year, four in 1894, three in 1895, one in 1896, and two in 1897.

As a result of their operations, 110 fishing boats and 341 fishermen have been saved, also 7 ships and 83 seamen. In addition 2,118 boats and 38 ships have received assistance when imperiled. The assistance rendered merchant vessels is mostly on the southern coast, and often consists in piloting them to safety when regular pilots are unobtainable, and competent men who are familiar with the coast are needed to insure the safety of vessels.

LIFE-SAVING BOAT.

Photographed by Muriaas.

The records of some of these boats indicate their usefulness as well as the skill and hardihood of those who man them. For instance, the *Bergen*, built in 1895, was officially reported on May 31, 1898, to have saved 21 boats and the lives of 70 fishermen, besides assisting 55 other boats. The *Colin Archer*, built a year earlier, at the same date had saved 16 boats and 69 men, and had assisted 294 boats. The *Langesund*, one of two built in 1893, had saved 12 boats and 23 lives, and had assisted 927 boats. When it is considered that the boats so assisted were in the most extreme peril, and that generally they would have been lost, together with their crews, except for the aid rendered by the lifeboats, the importance of this service can be better appreciated.

Other life-saving boats also have done good work, and all may well be proud of their records.

It may be mentioned here that before the introduction of this service the loss of life on the Finmarken coast was often considerable. In the fall, winter, and early spring gales rise suddenly on that far northern coast and blow furiously, generally accompanied by snow. Boats fishing a few miles offshore usually are unable, under such conditions, with the wind blowing fiercely off the land, to reach harbor. Often in former years the fishermen were compelled to anchor when they found it impossible to make headway against the sea and wind, and try to ride out the gale until it moderated sufficiently to enable them to reach home. But even if the boat weathered the storm, human endurance was too often not equal to the demands upon it. Thus confined within the narrow limits of a fishing boat, tossed about in a tumbling sea without possibility of adequate exercise, and with the biting blast of an arctic storm piercing to their vitals, the unsheltered fishermen have succumbed to the inevitable. On some occasions, after the subsidence of such a storm, boats have been seen riding quietly at anchor off the coast, and when visited the frozen bodies of the fishermen proved more forcibly than words could tell the hardship that could not be endured, and that courage and hardihood failed at last and the fishers lay down, like the Vikings of old, to yield up their lives in the boat that had so often borne them safely.

One of the recently built lifeboats may be described briefly as follows:

It is a carvel-built, sharp-ended, decked vessel; wide and deep; with curved, raking stem; moderately sharp bow, with slightly convex lines; sharp, hollow floor; a deep lead keel; well-formed run, and raking sternpost, curved near the top. It has a moderate sheer; flush deck; low open bulwarks; helmsman's cockpit aft; cabin companionway a few feet forward of cockpit, and winch aft of mast; also stout stanchions on deck, fitted to receive bolt of the small swivel gun used for firing life-saving projectiles; yawl-rigged, with running bowsprit; pole masts.

and sails made of very stout canvas. The sails consist of jib and jib topsail set flying (there are several sizes of jibs and fore staysails), fore staysail, mainsail, main gaff-topsail, and jigger or mizzen.

Following are the dimensions of a design of Olaf J. Olsen, of Bergen, from which the life-saving boats *Stadt* and *Bergen* have been built: Length over all, 44 feet; beam, extreme, 14 feet 4 inches; depth, rail to garboard, 7 feet 10½ inches; least freeboard, 3 feet 5 inches; area of immersed midship section, water line to garboard, 38.2 square feet; center of buoyancy, 0.90 foot forward of midship section and 1.73 feet below water line; metacenter, 2.26 feet above water line; extreme draft, 7 feet 6 inches; displacement, 925 cubic feet; mainmast, above deck, 42 feet; main boom, 19 feet; main gaff, 10 feet 5 inches; jigger mast, above deck, 21 feet; boom, 11 feet; gaff, 9 feet 6 inches; bowsprit, outboard, 13 feet 6 inches; gaff-topsail pole, 22 feet; sail area, 1,061 square feet; center of effort, a little over 4 feet forward of midship section and 22 feet above water line.

FIG. 31.—Gun harpoon with barbs closed.

Apparatus of capture, etc.—A large variety of apparatus is used in Norway in the capture of marine mammals and fish, and in the preparation of fishery products. It is, however, impracticable to do more in this report than to briefly describe some of the more important or interesting forms, since time and space preclude the possibility of anything approaching monographic treatment, however tempting the subject may be.

Most of the fishery apparatus is distinctively Norwegian, and some of it, the whaling implements, for instance, is exceedingly effective, and indicates inventive ability of no mean order.

Much progress has also been made in the manufacture of nets, which are quite equal to the best of other countries, but the hand-line fishing gear is primitive and indicates less advancement than is noticeable in other directions.

Whaling apparatus.—The successful prosecution of the whale fishery off the Finmarken coast depends upon having a harpoon that can be fired from a gun, and which at the same time is large and strong enough to raise a whale after it has been killed and has sunk; for most of the whales captured sink as soon as they are dead.

Captain Svend Foyn invented the great explosive harpoon used in the Finmarken whale fishery and for a number of years had a monopoly

of its use. Since then it has been generally adopted and some fifteen firms now use it.

The gun harpoon, of which specimens were exhibited by M. Jornsen, of Tonsberg, consists of a double shank for receiving the shackle, into which the hawser is bent. This shank is provided with an eye at its end, and is attached to the head (or "barb-holster") of the harpoon by a sort of swivel joint, the handle being held permanently in place by two nipples, one on its end entering the head of the harpoon, and another on the eye of the head of the harpoon, projecting into the handle. It is prevented from unjointing when the harpoon is fired by two arms locking over projecting lugs on the eye of the handle. (See figs. 31, 32.) As soon, however, as the "iron" enters a whale, and the barbs open, the shank is loosened, so that it will turn in any direction that the warp pulls it, for it swings easily on the swivel joint. This arrangement, which is a recently devised and most important feature of the Norwegian harpoon, obviates the possibility of bending the shank by the strain of the warp upon it, and enables the harpoon head to hold more firmly in the flesh of the whale. The harpoon is fitted with four large flukes or arms, and beyond these is an adjustable, bottle-shaped, cast-iron shell that contains the explosive, on the end of which is a cone-shaped point.

FIG. 32.—Gun harpoon with barbs open.

To prepare a harpoon for use the shell is screwed into place in the so-called "holster," and the pivoted flukes or barbs are secured to the shank (or "pole") by a rope-yarn. The four flukes, the harpoon head, the explosive bomb, and the shank now form a rigid, compact implement. But when it enters a whale the rope-yarn slips off, leaving the flukes free to open. As they spread their inner ends crush a glass tube containing sulphuric acid, which quickly flows through a hole in the screw and causes the explosion of the powder in the shell. If the "iron" has entered near a vital part the whale is killed at once, but sometimes the gunner — who is nearly always the commanding officer of a steamer — misses his aim and strikes somewhere else. In such instances the whale may be very difficult to kill and several additional shots may be fired before it succumbs.

The total length of one of the harpoons is 5 feet 8¾ inches; shank,

3 feet 6¾ inches; shell, 13¼ inches long and 4⅝ inches greatest diameter. Extreme length of the arms or flukes, 13¾ inches.

Different patterns of gun harpoons are used by the Norwegians, but the largest differ only in minor details. None are more modern or more formidable than that described above.

Some idea of the size of these implements may be obtained when it is stated that one of them, without whale line or shell, but with spun-yarn lashing and wire grommet, weighed more than 123 pounds.

Steel muzzle-loading guns, mounted on swivels, are used for shooting these harpoons. One exhibited was 3 feet long, with a bore of 2¾

FIG. 33.—Non-explosive gun harpoon with rigid head.

inches, but, according to Capt. Neils Jules, the largest are 1.2 meters long and 0.078 meter caliber. He gives the dimensions of the shell as 0.319 meter long and 0.104 meter diameter, while the charge of powder is about 1 pound.

There are several varieties of smaller non-explosive gun harpoons, some with rigid shank and others with the shank toggled or swiveled to the harpoon head in the same manner as that described. (See figs. 33, 34.)

These are used chiefly for killing bottle-nose whales, and are generally two-flued, but some have three flues. The specimens figured were

FIG. 34.—Non-explosive gun harpoon with swivel head.

exhibited by M. Jørnsen. The smallest of these had a rigid double shank, with a flattened, sharp-pointed, arrow-shaped head. This is provided with two folding flues, which are closed when the gun is discharged, but open after entering the whale, when the strain of the rope comes upon the harpoon. The objection to this form of apparatus is that the shank is liable to be bent and must be straightened before it can be used the second time.

The following are the dimensions of this harpoon: Extreme length, 3 feet 9¼ inches; shank, 2 feet 9 inches; head, 7⅞ inches long by 3¼ inches broad; flues, 5¼ inches long when open and 6¼ inches long when closed.

The larger of these harpoons had a pointed, arrow-shaped head, with two arms or flues fitted to close, similar to those in the one first described, and also, like it, having a swivel arrangement which permits of the shank turning in any direction after a whale is struck.

This form of harpoon, which is perhaps the most effective used in the bottle-nose whale fishery, has the following dimensions: Extreme length, 4 feet 2⅛ inches; shank, 3 feet; head, including swivel eye, 12½ inches long; head, 7¼ inches long by 4 inches wide; flues, 6¼ inches long when open, 7⅛ inches long when closed.

The warps used in the bottle-nose whale fishery are of the best hemp and are 2½ inches in circumference.

The gun used for shooting these harpoons is mounted on a swivel-post, and is hung in steel and brass gimbals, so that it can be pointed in any direction. It has a pistol grip; barrel 3 feet long, with 1¼⅜ inches bore; it has a brass lock cover, and is provided with breech-loading cartridges.

Toggle harpoons are usually carried on the whaling vessels, but are seldom used. It is also the custom for the steam whalers to carry the old-fashioned long-handled hand lance, for the purpose of killing whales in case they are not killed by a harpoon. But these are rarely used at the present day. This is due to the fact that the gunners on the whaling steamers have become so expert that it seldom happens they do not kill a whale at the first shot.

Long knives are used for cutting the blubber from the whales caught off the Finmarken coast, and this is stripped off by a tackle operated by a hand winch which is turned by three or four men. It takes two tides to strip a big whale, but sometimes a small whale is flensed in one tide.

Cutting spades are used in stripping the blubber off bottle-nose whales, the process being very similar to that generally employed on board other whaling vessels.

Implements for killing walrus and seals.—The killing of walrus is only an incident to the seal fisheries. The implements used are the rifle and a hand lance like that employed in the whale fishery.

Different implements are used for the capture of various kinds of seals. Young seals constitute an important part of the catch, and, in order to get these, vessels are forced into the ice fields in the vicinity of Jan Mayen until a herd of breeding seals is discovered on the ice, when the fishermen leave the vessels and engage in killing the young pups. For this purpose they are equipped with the so-called "seal club," consisting of a wooden handle, 4 feet 10 inches long, having at one end a steel implement so formed as to combine in one an ice pick, ice gaff, and hammer for killing the seals (fig. 35). The hammer is used to kill the young seals by hitting them a blow on the head. The pick at the end assists the seal hunter in making his way along the ice,

and the long, slightly curved prong or gaff is useful for many purposes, especially in pulling to him a cake of ice upon which he wishes to get across an open space.

Following are the dimensions of a seal club exhibited by H. Henriksen, of Tonsberg: Handle, 4 feet 10 inches; vertical ice pick, 2⅝ inches long; horizontal pick or gaff, 5⅜ inches long from handle; hammer, 1¼ inches long.

Apparatus for catching fish.—The apparatus for catching fish in Norway may be divided under three heads, namely: Nets, long lines, and hand lines. There are, of course, many different forms of each of these, but it is a notable fact that up to the present time no attempt seems to have been made in Norway to introduce the floating fish trap, or pound net, such as are used so extensively on the coasts and in the lakes of the United States.

It is not practicable, however, to discuss here in detail the many kinds of fishing appliances, nor is it deemed necessary to do so, since many of these are conventional and in common use nearly everywhere, while others are more or less obsolete.

FIG. 35.—Seal club.

Mention will be made of certain implements accessory to catching fish or used in the curing and preparation of them.

Nets and seines.—As a rule, the nets used in the fisheries of Norway correspond very closely with those of the United States, both in material and manufacture. Cotton and linen twines are now chiefly used, while the machine-made cork and wooden floats differ in no essential particular from those of American manufacture. It is true there may be some minor difference in size of mesh, etc., between the Norwegian gill nets used for herring and mackerel and those made here, but these are unimportant and scarcely deserving of extended mention.

The gill nets used in the cod fishery seem to be the only ones that are specially distinctive, but nets similar to those used in Norway were introduced in the fisheries of New England eighteen years ago, and are as well known in this country as almost any other kind of net. For descriptive details of this form of net and method of use, reference is made to a paper published by the writer in the United States Fish Commission Bulletin, Vol. I, pages 1–17.

The so-called "sink seine" was employed for several years in the Lofoten cod fishery, but was considered so destructive that its use

has been prohibited there. It is used for catching pollock and coal fish in some of the fjords, particularly on the coast of Finmarken. During June and July these species come into the fjords in great numbers and gather in schools on shallow spots, where there is often not exceeding 10 or 15 fathoms of water. Here the fish are taken in large numbers with the sink seines, which are lowered in the water from four boats and raised when a school of fish comes over them. The sink seine is simply a square or oblong sheet of netting of varying diameter hung so as to make it somewhat baggy (see figure 164 in chapter on Russia). It is sufficiently weighted to carry it to the

FIG. 36.—Catching small pollock in bag net.

bottom, where it is allowed to remain until the proper time for raising it comes, when the men in each of the four boats at the corners pull up on the lines and lift it to the surface. The net, as already stated, is baggy and the lines or ropes will easily come to the surface, while the inclosed fish find room enough inside the bag that hangs several fathoms below. The method of operation is simple. The men in each boat now pull in on the lines and net until the fish are brought to the surface in a compact mass, when they are transferred to the boats.

Another method of fishing with a bag net for small sei (pollock or coal fish), although differing in details, is somewhat similar to that last

described. Only two men, or a man and a boy, are required for operating this device (fig. 36). The apparatus consists of a large bag net attached to a hoop, resembling in form the old-fashioned lobster hoop-net formerly used on the New England coast, but very much larger, the diameter being 15 to 20 feet. For operating this net the boat is specially fitted with a derrick-like arrangement, consisting of a short mast and a long boom, the former being stayed with shrouds and the latter being supported by a lift, so that it stands at an angle of 30 to 45 degrees. To the end of the boom is attached a single block, through which is rove a rope that leads to a many armed rope bridle that supports the hoop of the net. Thus equipped the boat proceeds to a suitable location, where the net is lowered into the water to a depth of several feet. Bait is then thrown out to attract the pollock over the position occupied by the net. When a school of fish is gathered, the net is quickly raised until the hoop is level with or above the boat's gunwale, then, while one person pulls on the line to lift the hoop, the other gathers in on the slack of the net until the fish are brought to the surface, so that they can be easily transferred to the boat.

Drag seines are the only kind used in Norway, or at least no others were exhibited. These are of the old, straight pattern, consisting simply of a large sheet of netting hung in the ordinary manner, and intended for either dragging fish to the shore or else inclosing them in arms of the fjords. This form of seine is so well known that a detailed description seems superfluous.

Trawl lines.—The trawl lines used in the Norwegian cod fishery are similar to those employed by American fishermen, except that in the construction of the former tanned hemp line and galvanized eyeless hooks are used instead of the cotton lines and black, eyed hooks, which are so popular in the United States. The size of lines and hooks used on the Norwegian trawls vary considerably, according to the locality, the size of fish taken, and possibly other conditions. They also vary in the distance which the hooks are placed apart, but in nearly all cases the hooks are about the same distance apart as is customary on trawl lines used by American fishermen. On some of the cod trawl lines, however, the hooks were not so far apart as they commonly are on gear used on the banks by fishermen of the United States, but in size of line, length of gangings, and size of hooks, specimens examined more nearly correspond with the "shore trawls" of New England. One of these Norwegian lines had gangings 14 inches long, placed 4 feet 6 inches apart, and round-bowed galvanized hooks 1½ inches long. There were no floats on the gangings. The latter, as well as the ground line, was tanned. Sometimes the hooks are wider apart, and this is particularly true of the gear used in the bank fishery for ling and halibut. But these are simply differences of detail, and the construction of a trawl line is so well known that extensive men-

tion seems to be unnecessary. Reference may be made, however, to the fact that some of the Norwegian fishermen still prefer to have wooden or small glass floats on their gangings, although, judging from specimens of lines exhibited, I am led to infer that this custom has been abandoned to some extent.

Hand-line fishing appliances. There are many forms of apparatus used for catching fish with hand-lines. But, so far at least as the cod fishery is concerned, they are limited to a few general types, although these are subject to much modification in details which it is impracticable and unprofitable to follow here. The banana-shaped or crescent-shaped lead sinker, usually with one snood, but frequently with two and a corresponding number of hooks, is very generally in use along the coast of Norway for cod, pollock, and haddock fishing.

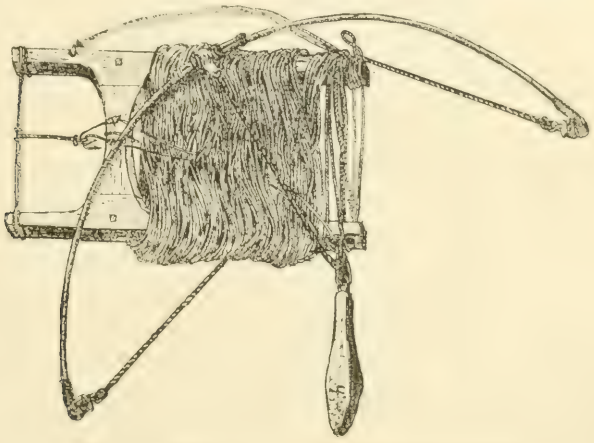


FIG. 37.—Codfishing gear. (Drawn by W. H. Abbott.)

Cod-fishing gear with an iron sinker, with or without a spreader, with one or more snoods and hooks, is extensively used, especially in Nordland, and it is difficult to say whether this has a wider application than the gear with a lead sinker.

There are differences in weight of sinkers, also variations in spreaders and material used for snoods or gangings, but the principle of arrangement may be classified under one of a few forms, to which, of course, there are exceptions, though the latter are comparatively unimportant because of the lack of wide application.

Besides the more common appliances, there are special kinds of apparatus, such, for instance, as decoy hooks, to which reference will be made.

The fisheries for mackerel, small pollock, etc., employ forms of hand-line gear different from those alluded to above, a few of which are sufficiently important to deserve mention.

Nordland two-hooked hand-line gear.—One form of cod-fishing gear used in Nordland has the typical Norwegian iron sinker, square in cross section and tapering to a blunt point at each end, the upper end being provided with an eye to receive the line and spreader. The latter is made of iron wire, which is passed through the eye of the sinker, where it is bent so that the arms reverse their direction, and each end of the spreader is turned over to form a hoop-shaped eye. The spreader is about 15 inches long. The upper ends of the snoods bend into the eyes of the spreader, while the lower ends receive the hooks or the gangings to which they are fastened.

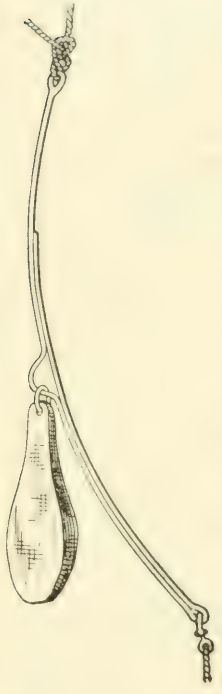


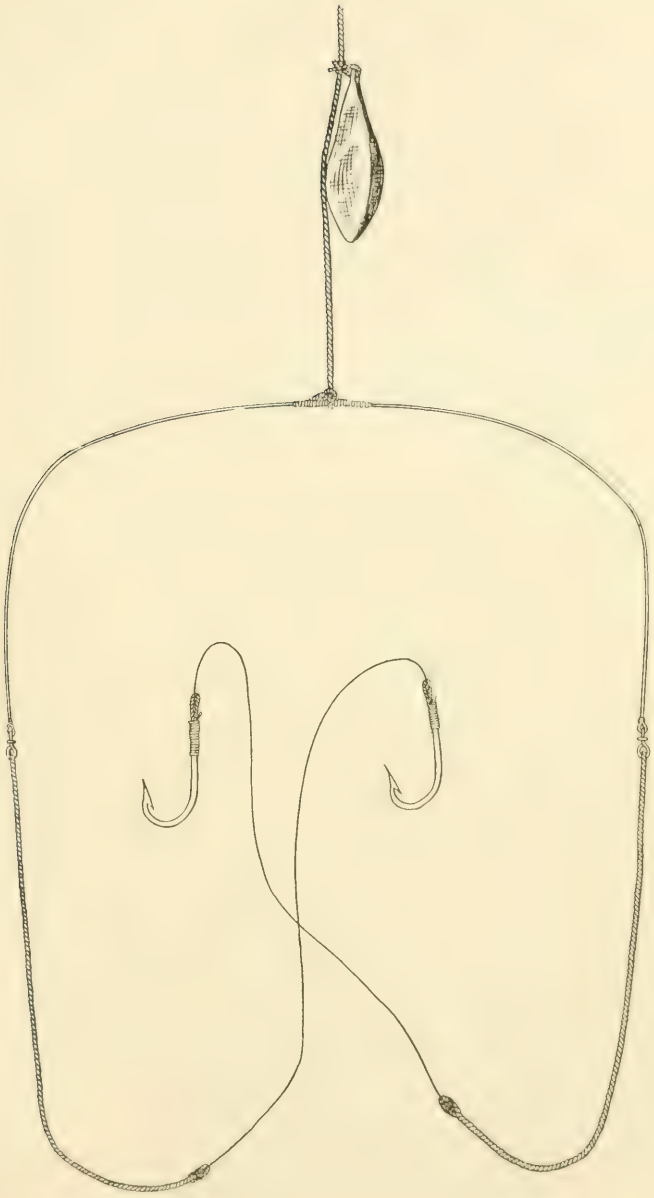
FIG. 38.—Cod-line sinker and spreader. (Drawn by J. W. Collins.)

Conventional shaped hooks are commonly used, generally galvanized and much larger than are in favor for the same size of fish in the United States. The line is hemp. Another form (fig. 37) is similar to the haddock gear (Pl. XXIII), but larger.

Nordland single-hook gear.—This style of hand-line cod-fishing gear appears to be more in favor than any in Nordland. The iron sinker is used. The specimen studied (fig. 38) had a wire ring in the upper end of the sinker. A sort of spreader-like device of wire, double throughout about three-quarters of its length, passes through the wire ring, being bent so as to form a sort of half loop which is closed by overlapping the wire turned back from the lower end. This spreader has an eye at its upper end to receive the line and an eye-shaped loop at the lower end in which is fastened a small brass swivel. The upper end of the snood is spliced into this swivel and the lower end is fastened to the hook by twine.

The following are the dimensions: Length of spreader, 18 inches; length of sinker, 6 inches; greatest diameter, 1⅜ inches; length of snood, 8 feet 3 inches; length of hook, top of shank to lowest point in bend, 6 inches; spread of hook, 2¼ inches.

Finmarken hand-line gear.—The gear used at Finmarken appears to be an improvement on that of Lofoten. It has a blunt-ended iron sinker, 9 inches long by 1⅛ inches greatest diameter. A few inches above the sinker is a curved-wire spreader about 3 feet long, the ends being 32 inches apart. This passes through a leather strap into which the hemp line bends. The snoods are smaller than the line, and are each 32 inches long. They bend to gangings that are 18 inches long. The latter are simply small pieces of line, one end of which is bent into a loop at the hook and the other into the lower



HADDOCK HAND-LINE GEAR.

Drawn by J. W. Collins.

end of the snoods. Galvanized round-bowed hooks 3 inches long are used.

The line is wound on a double-pronged reel, 25 inches long, 12 inches wide at lower or open end, and 8½ inches wide at the upper end.

Fig. 39.

Haddock hand-line gear.—A common form of hand-line gear used for catching haddock (Pl. XXIII) has the common iron sinker. The line passes through the hole at the top, where it is seized together, so that the end comes 8 or 10 inches below the sinker, and is bent to the middle of a long, curved-wire spreader, at the ends of which are small swivels to receive the snoods. The latter are comparatively short, each with an eye at its lower end. Galvanized, round-bowed eyeless hooks are used, these being about 2 inches long (fig. 39). To the top of each of these is fastened a short line loop, into which is bent a long snood or ganging of fine brass wire, the upper end of which is bent into the lower end of one of the line snoods.

The sinkers are usually about 6 inches long by 1½ inches diameter; the spreaders are 3 feet long; the line snoods each 18 inches long, and the wire snoods about the same length.

Fig. 40.—Cod-line sinker. (Drawn by J. W. Collins.)

Lofoten lead-sinker gear.—The most common, if not the only, form of lead-sinker used in the cod fisheries of the Lofoten Islands and probably of all Nordland has a semi-crescent shape; it is somewhat flattened, moderately concave on one edge and strongly convex on the other; the ends are pointed, and each is perforated with a hole (fig. 40). The line bends into the upper end or into a loop fastened to it, and there is a loop at the lower end into which the single snood bends. Sometimes, if not generally, these sinkers are thinnest on the convex side, so that they will have less resistance to the current when the tide is running.

The snood varies from 5 to 7 feet in length, but it is usually about 6 feet long. A round-bowed hook is generally used, this being about 4¼ inches long. The lead described is 10½ inches long and 1¾ inches greatest width.

Hemp lines are used, and these are almost invariably wound on a two-pronged reel, with one end open, so that the line will run off easily.

A hand-line gear of this form, used at Kaalvag, in the Lofoten Islands, differs somewhat from that above described. The lead-sinker is similar, but somewhat wider and thicker in proportion to its length;

it weighs about 2½ pounds, and is 5½ inches long, 1⅝ inches extreme width, and 1 inch greatest thickness. In the hole at each end is a line loop; one of these serves for a tail for the line to bend into and the other is a horse, in the end of which is bent the snood. Both are served their entire length—from 5 to 8 inches—except where the loop is formed at the ends. A noticeable feature is a piece of whalebone (baleen) put into the hole under the line, to prevent chafing.

At Söndmöre, too, the same form of gear is used, but the sample studied is rather larger than either of those referred to. The line is hemp and weighs about 6 pounds to 300 fathoms. The lead-sinker is the same in shape. It is 11½ inches long, 1⅝ inches extreme width, and $1\frac{5}{16}$ inch thick, and weighs about 5 or 6 pounds. The snood is much smaller than the line and about 6 or 7 feet long.

Lister hand-line gear.—A peculiar kind of hand-line gear is used for catching cod and pollock on the southwest coast of Norway, and especially at Lister.

The lead-sinker is of the sow-bug pattern, 3⅞ inches long by 1½ inches greatest diameter, and probably weighs about 1½ to 2 pounds. It has a wire eye cast into the upper end of it, and two long wire horses or spreaders in the lower end, these spreading from the sinker at an angle of about 25 degrees. These are each 14¾ inches long, and are provided with swivels at their lower ends to receive the snoods, which are from 3½ to 4 feet long. Galvanized round-bowed hooks, about 3 inches long, are used.

Small lead sinkers are also used, with a horse of wood or brass, and having only a single snood and hook. These sinkers usually are from 2¾ to 3 inches long and weigh about a pound or less. The horse is 8 to 12 inches long.

It is not uncommon on gear used for small fish, including mackerel and pollock, to have a cup-shaped device of leather, with about the capacity of a large teacup, hung in an inverted position alongside the sinker. This leather cup is filled with fine tole bait, which is pressed in tightly. After the gear is lowered the bait gradually soaks out and attracts the fish in the vicinity so that more can be caught. The hooks used are generally small, often not larger than an ordinary mackerel hook. Some are of improved forms, like the Limerick hook.

Jiggers and decoy hooks.—It is not uncommon in the cod-fishery for bait to be scarce or unobtainable when fish are exceptionally abundant. To meet this condition the fishermen (and others) have invented various devices, such as jiggers or other artificial lures, to deceive and attract the fish, and thus to make their capture possible with hand lines without the use of bait.

Perhaps the most common forms of these heretofore in use are fish-shaped jigs of pewter or lead cast on to the shanks of hooks—from one to three hooks in each—which, when kept bright and moved up and

down in the water in simulation of the movements of small fish that the cod preys upon, serve to attract large numbers of the latter around the glittering object. Thus, though the cod do not swallow the decoy fish, it is liable to be hooked by the jigger. Many fish are sometimes caught this way.

Jiggers with fish-shaped decoys of glass on the shanks of the hooks are in favor in Norway. These glass decoys are sometimes silvered, so that they glisten in the water, and some are brown or other color which will best imitate a small fish. These may have only a single hook, but some have two hooks.

Another favorite device has been to cast a jig 3 or 4 inches long on the shanks of two or more large cod hooks. The jig does not cover the whole length of the shanks, which are about 1½ inches above the lead. To the upper part of the hooks, therefore, is fastened double gangings 15 to 18 inches long, and to these are attached, at intervals of 4 or 5 inches, fish-shaped pieces of bright tin, which hang loosely. As the "jigger" is moved up and down in the water these attract the fish. The object is to gather a school of cod, pollock, or other fish around the jigger, so that when it is raised with a sudden jerk one or more of the fish will be impaled upon the hooks.

The natural result of the use of such apparatus is that many fish are badly wounded and escape, perhaps to die of their injuries. For this reason the Norwegian Government has prohibited the use of such devices.

Small pollock are often caught with pole and line from boats, and mackerel are sometimes taken in the same manner when they go into the fjords. The apparatus is simple, as a rule consisting only of a hook and line fastened to a flexible pole made of a small sapling.

Shark-fishing gear.—The apparatus used for catching the ground shark (*Scymnus microcephalus*) consists of a stout hand line fastened to the chain ganging of a large hook from 7 to 9 inches long. The modern hook is usually galvanized, and it is necessary to have several feet of small chain next the hook, otherwise the line would be bitten off by the sharks.

Squid or cuttle-fish gear.—The squid jigs used by the Norwegians may be classified under two general heads, the old and modern styles, though there are variations in each of these. The old style squid jig is made of wood, with a cylindrical base and tapering top, which is perforated by a hole that the wire ganging bends into. Attached by seizings to the base of the jig are several hooks, or pointed wires bent into the shape of hooks. One of these jigs had eight hooks. Length of wooden part was 7 inches, and its greatest diameter 2 inches. The distance from the base to the point of hooks is about 2 inches. In addition to the seizing passing around the shank, there is a seizing of twine run from one hook to the other. The Norwegians often attach

little strips of fish skin about 6 inches long, cut in the shape of a fish, to the ganging, at a distance of 1 or 2 feet above the jig and the same distance apart. The object of this is to attract the squid, so that when the jig is pulled suddenly it will impale them.

The modern jig consists of a steel wire, with eye at the top and a cone-shaped piece of lead at the bottom, into the top of which is fixed a number of stout pins standing out at an angle from the shank. About halfway from the bottom of the jig to the top of shaft are attached three hooks of the size ordinarily used for trawl-line fishing for cod. One of those examined had a shank 23 inches long, the lead part at the bottom being 3¾ inches long, 1½ inches greatest diameter, and provided with 17 pin hooks, each 2 inches long. A swivel is fitted into the eye at the upper end of the shank, and to this is attached the line, which is about the size of ordinary ganging line for cod. In some cases the squid jigs are much smaller than the one referred to, and some of

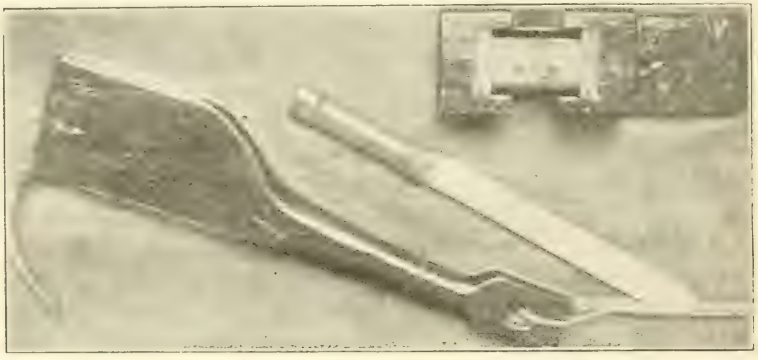


FIG. 41.—Halibut gaff, halibut knife, and line roller.

them are very primitive in type. In a few instances barbed hooks have been used, but these can not be employed to advantage for squid fishing.

Some of the jigs are like those of American make, but apparently such are not so commonly used as those made by the fishermen themselves.

Spears and gaffs.—Not many implements coming under this classification are used for catching fish in Norway.

Halibut spear.—In certain parts of Norway where halibut occur, and where the water is so clear that the fish may be observed on the bottom at a considerable depth, a two-pronged spear is used for their capture, this being provided with an iron handle into which it screws. The handle has cast on it a large, elongated, square leaden weight, which gives the spear sufficient momentum, when suddenly dropped, to enter the fish with the requisite force to bury the prongs in its flesh. Total length, 2½ feet; length of prongs from curve, 6 inches; length of leaden weight, 9¾ inches; average diameter of leaden weight, 1¼ inches; length

of handle above weight, 12¾ inches. The upper end of the iron handle is worked into an eye into which the line is bent.

Cod and halibut gaffs.—There are various kinds of hand gaffs used in the boats for gaffing codfish and halibut. Some of these are barbed like a hook, and others somewhat like a harpoon. The handles are usually of hard wood, thick and heavy at the lower end, which is used as a club to kill the fish, while there is a hand clasp at the upper end. The extreme upper end, however, usually has a knob or a hook on it to prevent the hand from slipping, and the halibut gaffs generally have a hole in the upper end with a long becket or line in it, so that if the fish takes the gaff away it will not be lost. The handle of one of these halibut gaffs (fig. 41) is 22 inches long, 5 inches greatest width, and 2 inches thick in the lower section. The metal hook is 6 inches long. Another of these gaffs (fig. 42), which was not barbed, had a handle 17½ inches long, 5 inches greatest diameter, and 2¼ inches extreme thickness.

The Finmarken cod gaff has no barb, and has a lighter handle 21 inches long, with a notch at its upper end so that it can be used as a gulleter.

FIG. 42.—Halibut gaff, trawl rollers, and fish knives.

The gaff used at Arendal is similar to that last mentioned. The handle is 17½ inches long, with an extreme width of 2 inches.

Eelpots.—Several varieties of eelpots are used, these being generally bottle shaped. The old style is made of ordinary withes, with the usual funnel-shaped entrances, these, however, being permanent. The new-style pots are made with one and two funnels, according to the size, the funnel-shaped entrances being so attached that they can be removed for emptying the basket. Length of old style, 2 feet 7 inches; greatest diameter, 11 inches. Length of single funnel, new style, 2 feet 9 inches; greatest diameter, about 11 inches. Length of old pot with double entrances, 4 feet; greatest diameter, 2 feet.

Lobster pots.—There are various kinds of lobster pots, some of which have been improvised by the fishermen from barrels and other materials which they had at hand. Two very interesting specimens of these have been used, respectively, at Söndmöre and Espevær (fig. 43). The former consisted of a half barrel fitted at each end with a

net head, entrance made of seven wooden splints about 1 inch wide and pointed at their inner ends. It had a door on top, 5½ by 6 inches, hung on line hinges. The Espevær lobster pot was also made of a half barrel, in which a number of three-fourths-inch holes were bored. On top was a rope becket for lifting the pot, and an adjustable door 6 inches square. The heads were made of wattles wove through thin wooden splints, which extended inward 3 or 4 inches beyond the woven part of the head, so as to form a funnel for the entrance of lobsters.

The most common form of lobster pot heretofore used is cylindrical in form, with wooden frame covered with netting, and provided with a funnel-shaped entrance at each end and an adjustable door for

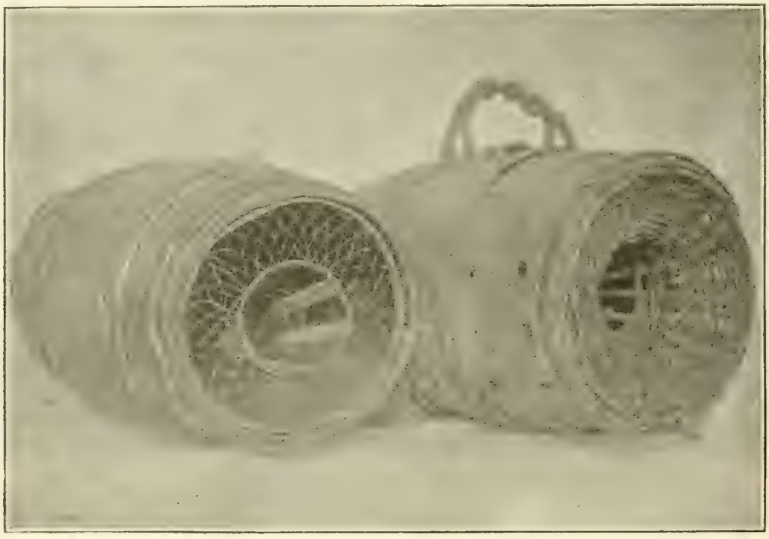


FIG. 43.—Söndmöre and Espevær lobster pots.

removing the catch. Pots of this description were 2 feet long, 14 inches in diameter, with doors 7½ inches long, while the diameter of the funnel-shaped entrance was 4 inches.

The most modern form of lobster pot used in Norway is made of galvanized iron wire (fig. 44). Various sizes of these were exhibited by Fr. Christensen, of Christiania.

This device is made of wire attached to wooden sills. It is cage shaped, provided with two entrances, and weighted in the bottom with a large flat stone. Length, 24½ inches; extreme width, 13 inches; extreme height, 16 inches; diameter of funnel hoops, 4 inches.

Larger sizes are used up to 2 meters in length, but the dimensions given are apparently those most in favor.

Winches and rollers.—Several forms of winches and rollers are employed in the fisheries in connection with gill nets and trawl lines.

Net winches.—In recent years various devices have been invented for heaving-in nets, and particularly drift nets, which are set off the coast for mackerel. The accompanying illustration (fig. 45) shows an improved Norwegian form of apparatus for this purpose.

Net rollers.—Wooden net rollers are in general use on all boats employed in gill-net fishing. They are usually made of soft wood and are fitted so that they may be attached to the boat's gunwale. These rollers vary materially in size, but are usually from 4 to 6 feet in length and from 4 to 6 inches in diameter.

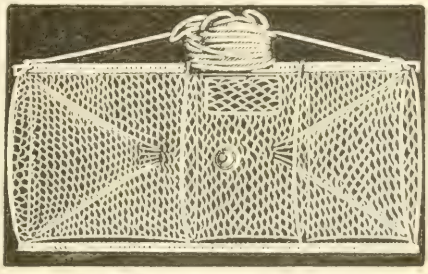


FIG. 44.—Wire lobster pot.

Line winches.—When long lines are hauled on board of a vessel or large boat the strain is often so great that it is difficult to pull them in without mechanical appliances. The need for the latter has led to various inventions to facilitate haul-

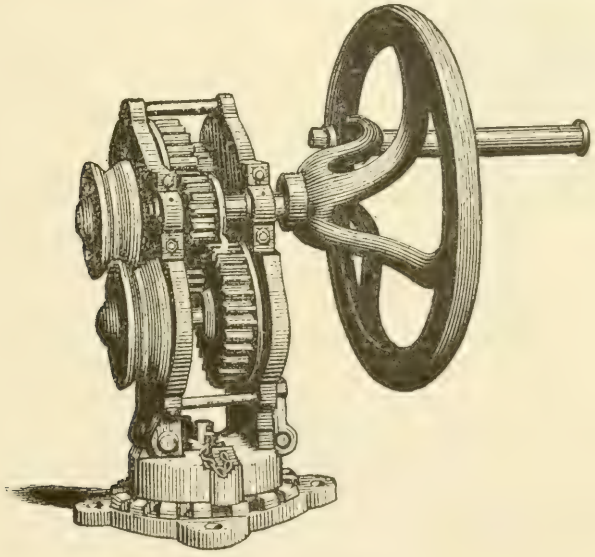


FIG. 45.—Net winch.

ing trawl lines under such conditions. One of these winches was exhibited by Mr. H. Olsen, of Aalesund (fig. 46). This is considered one of the most effective devices for the purpose. When in use it is generally stepped on the rail of a vessel or boat in the most convenient position for operation. One or two men operate the handles, while one man coils the gear and another takes off the fish as the line is brought on board or before it passes over the winch.

Line rollers.—Rollers ordinarily used on boats engaged in the long-line fishery are usually made by the fishermen of wood or of wood and bone, although occasionally a wooden roller may be fixed in an iron frame. These are commonly called trawl rollers by American fishermen, and are arranged so that they can be attached to the gunwale of the boat in order that the trawl line may be hauled across the roller and thereby ease the friction.

The nearest approach to an American trawl roller seen among the Norwegian fishery apparatus was one used at Finmarken (fig. 42). The roller is made of wood, and is 6 inches long by 4¾ inches greatest diameter. It is fitted into an iron frame, which has a prong at each end to stick into the gunwale of a boat.

A line roller used at Berge (fig. 42) was made of wood and bone. The roller or revolving part was made of bone and was fitted into a sort of box, open at the top, and with a flat extension at one end, with a hole in it, so that it can be fastened to a boat's gunwale. The bone roller was 4⅛ inches long, with a diameter of 2½ inches, and the total length of the device was 14 inches. Another roller of the same kind (fig. 41) was somewhat similar, having an extreme length of 12 inches, while the bone roller was only 3¼ inches long.

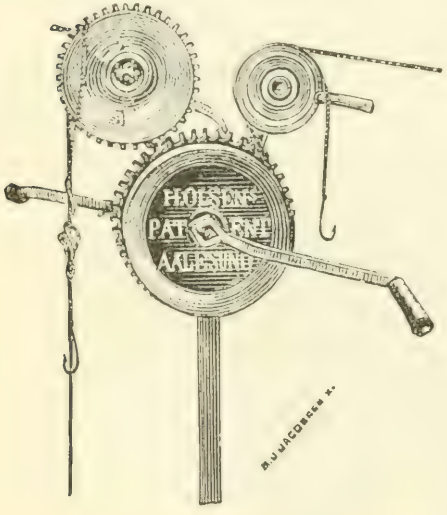


Fig. 46.—Line winch.

Killicks and grapnels.—Stone killicks are yet used in Norway, and are similar in type to those employed in the fisheries of New England. A primitive wooden grapnel is used in dragging for sunken nets. This consists of a staff of spruce, to which is attached by strong seizings of cod line 5 wooden prongs. The total length is 20½ inches; length of prongs, 6 inches. At the upper end is a hole, into which is spliced a strap of hemp rope little larger than ratline stuff. At the lower end is also a hole, which is for the purpose of attaching a weight to keep the apparatus close to the bottom.

In recent years an iron grapnel, provided with six prongs and placed tandem, is used for dragging for sunken nets or other fishing gear. Usually three grapnels are attached to each other by a small chain. These are essentially the same as those used by the New England trawl-line fishermen for securing sunken trawls. Length of grapnel,

17 inches; length of prongs, 6 inches; length of chain connecting them, about 4 feet.

Knives.—Knives used in the Norwegian mackerel fishery are like those of American manufacture, and to a large extent have been copied from them.

The knife in general use for splitting cod (fig. 42) has a short, broad blade 3½ inches long by 2¼ inches wide, set in a wooden handle 7½ inches long; the handle being formed so that it is much smaller in the middle than at the end.

The knife commonly used for ripping codfish, or what in the United States would be designated as a throater (fig. 42), is a single-edged, sharp-pointed implement, with a blade 6¾ inches long by 1¼ inches wide, set into a handle 11⅝ inches long, this having an iron ferrule next the blade. The handle is smaller where the hand comes than at either end.

The knife used for cutting halibut (fig. 41) has a sharp pointed blade 12 inches long by 1½ inches wide, set into a wooden handle 6 inches long. This is similar to the knives used for the same purpose in the United States.

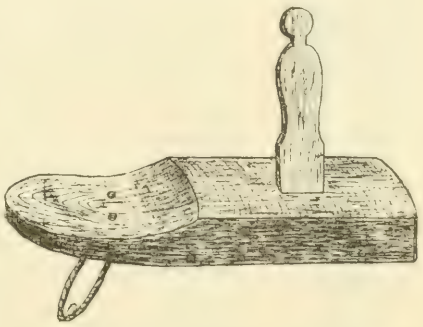


FIG. 47.—Line buoy. (Drawn by W. H. Abbott.)

Buoys and bailers.—The buoys ordinarily used on the long lines and nets of the west coast of Norway (fig. 47) are made of pine or spruce plank, in one end of which is a becket of hemp rope about the size of ratline stuff. This end is curved up from below like the bow of a scow; the other end is square. In the center of this is placed an upright with a curved top. There is some variation in the size, but ordinarily the size is pretty uniform. Dimensions: Length, 3 feet; width, 9½ inches; thickness 3 inches; height of upright, 19½ inches; width, 4 inches; thickness, ¾ inch.

Egg-shaped glass buoys are used to some extent where the current is strong, or nets are set at the bottom, as in the codfishery at Lofoten.

Buoys, generally made of hard wood, but sometimes made of soft-wood staves, conical in form, and with a staff running through the center, are most serviceable for deep-sea fishing on the Storregen bank or on the shore grounds. Conical buoys of smaller size (fig. 48) are used inshore for nets or lines.

For bailing the Nordland boats, the fishermen use a large wooden dugout bailer, shaped something like one end of a bread tray, with an open handle or hand grasp. Next the handle end is a sort of half deck, to prevent the water from slopping out when bailing, and in front of

this, extending from side to side, is a loop or strap made of withes, so that the person bailing can take hold of it with one hand for more convenient manipulation. Length of bailer, exclusive of handle, 19 inches; extreme depth at rear, 5½ inches; extreme width, 11½ inches; length of handle, 7 inches; mortices for hand grasp, 4¾ by 2¼ inches.

Bailers of the same shape and construction, but small enough to be used with one hand, are in common use.

Fish products. The success of the Norwegian fisheries depends on the demand for fishery products in other countries and every practicable effort is made to promote the export trade. It is true that certain products, such as the cod, haddock, ling, and pollock, are cured in the same manner as they have been for centuries, but this is due to the fact that there has always been a demand for them, and also because they are apparently better for exportation to countries having a warm and humid climate than fish cured in any other manner. Then, too, this method has the advantage of being well-known in the world's markets, and also of being adapted to the curing of large quantities of fish at the smallest cost.

FIG. 48.—Conical buoy. (Drawn by W. H. Abbott.)

Still, progress in the preparation of fish food is so important to the successful maintenance of the Norwegian fisheries, that it is not surprising new methods have been extensively adopted in certain directions, and that experimentation is constantly in process with the object of improvement. Thus we find that much advance has been made in recent years in canning fish products, and in the preparation of evaporated material, like fish meal, which can easily and quickly be made ready for the table. The old method of producing fish meal was to grind up fish that had been dried in the ordinary way. At the present time, however, the same result is reached by artificial evaporation, and it is claimed, apparently with justness, that this product is much superior to that prepared formerly. Haddock are chiefly used for this purpose. The product is very dry and is as fine, almost, as flour. It is claimed that it "contains 85 per cent albumen, its nutritive value being consequently four and a half times greater than that of lean, boneless beef." It has the additional advantage that it will keep for an unlimited time in any climate.

The following information regarding the preparation of this product has been furnished the writer by the manufacturers:

This fish flour is prepared from fresh fish (haddock). The skin and bones having been removed, the meat is passed through an artificial drying process. The drying is done so quickly and at such a low temperature that the meat of the fish does not undergo any change except in this, that nearly all the water which it contains is evaporated.

The fish flour, for that reason, contains all the nutritious ingredients of the fresh fish, and is just as palatable.

From 20 parts fish only 1 part fish flour is produced through this drying process.

The whole process, from the time the fish is caught until it is ready as an article of commerce, consumes only twenty-four hours.

Other noticeable preparations of fish food which might prove suggestive to American packers were the following: Fish pudding; salmon, boiled, marinered, and smoked, in oil; smoked sturgeon in oil; skinned and boneless smoked herring in oil; fish cake fried in wine sauce, in curry, and in jelly; halibut in wine sauce; smoked herring in jelly, and boiled cod roe.

There has recently been introduced into Norway a method for preparing shredded codfish, dried without the application of salt. A similar system to this was invented and put to use to a limited extent in the United States some years ago. By this method fresh codfish could be shredded and dried by artificial means. Samples of this product were exhibited at the Centennial, and at one time a plant for the production of the material was established at Gloucester, Mass. The demand for this product, however, was not sufficient to make possible the continuance of its manufacture. Americans did not, as a rule, appreciate the increased value of fish for food when it was divested almost entirely of water and reduced to a condition in which it could be kept indefinitely or transported to hot climates. It is probable, however, that it will prove profitable to Norway, inasmuch as many of its most important markets are found in tropical countries. Fish so prepared is unquestionably preferable to the old-fashioned stock fish, since the material is pure, boneless, and skinless, and can be made ready for the table at short notice. It can also be packed in air-tight boxes or tins, and thus be kept from contact with the atmosphere or exposure to dirt.

The preparation of this kind of shredded fish is said to be carried on quite extensively at Bodo, where a factory was built in 1892 by Frederik Backer, the daily production of which is stated to be upward of 2,000 pounds.

Smoked cod roe, a meal made of cod roe, and preserved fish liver are products that have not been prepared in a similar manner in the United States, so far as I am informed. While fresh cod roe has been utilized to a very limited extent in this country for food, no attempt has been made, so far as I am aware, to prepare it by smoking or by drying and grinding it into a meal for food purposes. In view of the great quantities of cod roe obtained from the shore fisheries of New England, and which, at best, is salted and sold at a very low price, it would seem important that experiments in preparing it for introduction into our markets might be undertaken with promise of profitable returns.

The manufacture of "fish puddings" is an enterprise that well might be imitated in other countries, such as the United States, for instance, where many species of cheap but nutritious fish abound.

In the manufacture of fishery products of this kind, a device exhibited by Nullmeyers Brothers, of Christiania, has been an important factor. This is a machine designed for the special purpose of cutting the fish into a pulpy mass. It consists of a series of crescent-shaped knives fixed to one end of a shaft and working in a bowl-shaped metal receptacle holding the fish, the knives being driven by machinery operated by steam or hand power. This machine is effective and reduces materially the cost of preparing the fishery products referred to.

The process of canning fish products is extensively prosecuted at Stavanger, which appears to take precedence of any other place in Norway in this particular.

The Stavanger Preserving Company exhibited various kinds of canned fish, including fish puddings, and fish balls in bouillon and sauces. With the exception of the last-mentioned articles most of the other material was similar in kind and treatment to the ordinary canned products.

This company is the oldest engaged in canning in Stavanger, and its history indicates the development of this industry in Norway. It was established in 1873. During the first five or six years the chief object was the preparation of "ship's provisions" especially meat—anchovies, and other delicacies. This, together with making empty boxes, employed only 16 or 17 persons at most, including the superintendent, 4 tinners, 2 male and 8 to 10 female laborers.

In 1879–80 the Appert system was introduced and a smokehouse was added.

The company writes:

> While formerly the sprats had only been made into anchovies—which, indeed, is still a chief article of our trade—we made this year the first attempt at canning smoked Norwegian sardines in oil, which products quickly gained ground and afterwards have become such remarkable articles of exportation from our town, having also been introduced to trans-Atlantic places.

Subsequently other improvements were made in appliances and methods, and to-day the result is seen in the manufacture of cans by the most approved machinery and a corresponding advancement in other directions, all of which is typical of the general progress made in packing fish in Norway.

It is pertinent to mention in this connection the excellent practical work accomplished by the fishery schools of the country, which have done so much in the way of experimentation to introduce new methods and to indicate how various cheap or waste products of fishery can be turned to good account—a work of such paramount importance to the fishery industries that it is worthy of imitation in the United States.

Through the courtesy of Mr. Fr. Backer I had the opportunity to test some canned fishery products put up by the fishery school at Bodo, where experimentation is carried on in order to secure the best method of utilizing various kinds of fish, and particularly to prepare low-priced species, or such parts as are not usually eaten, in such a way as to make them attractive and delicious foods.

The first tried was pollock (sei), put up for fish cakes ready for cooking. The cakes were excellent, and fully equal to the best codfish cakes I have eaten.

Rolled herring ("Ralmops"), shirred herring, boiled and rolled, put up with onion and spice-flavored vinegar sauce—one-third vinegar and two-fifths water—were especially good.

Halibut heads and fins, canned, I think, in their own oil, were also excellent. Many tons of halibut heads are annually pressed for their oil in the United States, when a delicious article of food could be prepared from them.

But, while improvement is evident in many directions, conservatism prevails to a considerable extent. Reference has already been made to the methods of curing cod as stockfish and klipfish. These are so well known that it is scarcely necessary to say that the former is cured by drying without salt, and the drying is so thorough that nearly all of the moisture in the fish is removed, so that cod cured this way can be taken to tropical countries without spoiling. It follows, however, as a matter of course, that it requires time and much soaking to prepare fish for the table which are cured in this manner, and the tendency of the times is to have food products that can be made ready for use in the briefest time. The split, light-salted, and hard-cured klipfish—so called because they are dried on rocks or stones—are similar to much of the dried fish of Canada and Newfoundland, and are also adapted to exportation to tropical or semi-tropical countries.

But there is much waste in preparing either stockfish or klipfish for the table, since the work must of necessity be done mostly, if not entirely, by inexperienced people. For this reason there is seemingly an effort being made in Norway to pack boneless fish, or at least dried cod that has been skinned and from which the larger bones have been removed.

It may take some time to introduce goods packed in this manner in some of the markets which Norway exports her fish to, but it is, nevertheless, reasonable to suppose that the advantage of having products so packed will be realized in time, and that most people at least will prefer an article of food in which waste has been reduced to the minimum to products in which the item of waste is a large factor.

The lack of a legalized systematic method for packing herring, and the fact that every curer is substantially a law unto himself, is doubt-

less detrimental to the best interests of the Norwegian herring fishery, for, as the matter now stands, the brand fails to be a guarantee of the quality beyond the reputation acquired by the packer. It is conceded by the best informed that this is so, and that the cure of one year may be far superior to that of another for the same brand, even if the fish are packed by the same curer, while the variation of qualities put up by different curers may be considerable in the same season.

When it is understood that upward of $200,000 worth of herring have been exported to the United States from Norway in a single year, the Norwegian methods of cure and regulations for packing become questions of importance to citizens of this country.

Mackerel are cured by the American method, due to the fact that the largest market is in the United States.

Cod-liver oil for medicinal use was exhibited by various firms. It is, however, so well known that a bare allusion to it must suffice, notwithstanding its excellence and its importance, or the temptation to dwell upon its preparation, concerning which much data is available.

Norway is a large producer of marine oils, among which are different grades of brown cod-liver oil, shark oil, and whale oils.

Fish are cured by smoking to a large extent. This applies more particularly to herring. The Norwegian smoked salmon has a high reputation, due to care and skill in curing.

There is apparently a growing tendency to market fresh fish in foreign countries, as a result of improvements in refrigeration and transportation. England appears to be the chief market for fresh fish. Large quantities of herring are sent there in steamers; also salmon, halibut, and lobsters.

Among the most important accessories of fish packing was the new barrel exhibited by the inventor, Mr. George Ross-Lund. This is a straight-bilged, wooden cylinder, constructed of sawed, factory-made staves, and hooped with iron. Aside from other advantages this kind of barrel can be made cheaper than those in ordinary use, because the staves being of uniform width they can readily be prepared for use by machinery.

It must be confessed that this cylindrical barrel is so different in appearance from the conventional barrel that the first impression one receives is liable to be an unfavorable one, for life-long prejudices in favor of a round-bilged barrel, and the thought that no other form is suitable for such a receptacle, impel one to look with distrust upon anything radically differing from what one has always seen. One feels at the first glance that the new barrel is weak—at least that was my impression. But careful consideration convinced me otherwise. The advantage of a straight-bilged cylindrical barrel over the ordinary form for stowage is too evident to require discussion, and the gain in this respect is an item of much importance. At the same time it will

be evident that barrels which, when stowed in a vessel's hold or elsewhere, bear the strain on them uniformly throughout their entire length, are more liable to resist successfully than if the strain comes only in one place the middle of the bilge—as must be the case with the conventional round-bilged barrel. For this reason there is liable to be much less leakage in using the new device, and, since the loss on pickled fish by leakage is often large, the opportunity to obviate it is a matter of considerable moment to fishermen and fish packers.

Ordinarily, each barrel has from 4 to 6 iron hoops; these are quickly fastened by a patented device made specially for the purpose. The staves are recessed to receive the hoops, so that the latter will not slip. Barrels made for special purposes have additional hoops, but in all cases the calculated strength of the hoops is in excess of that of the combined strength of all the wooden hoops usually put on a barrel.

The facility with which these new barrels can be put together, opened, or headed up was a matter of surprise and gratification. It is safe to say, from the observations I made, that coopering can be more expeditiously performed than with the old-fashioned barrel. Another advantage is that, after a barrel has served its purpose for the first time, it can readily be shooked and shipped back at a minimum cost of freight.

It is also specially adapted to the shipment of oil and certain other kinds of fish products, for its shape is such that it will readily receive a metal or porcelain cylinder inside. Oil can be shipped in a protected tin cylinder, and thus be carried safely and with an immunity from waste or leakage. And certain kinds of food delicacies can be shipped in larger packages than now, and probably with greater assurance of success, by having metal or porcelain receptacles to fit inside the barrels.

Possibly no other Norwegian exhibit offered a suggestion more important to fisheries than this, and certainly none was more novel. I understand that the Ross-Lund barrel is meeting with general favor in Europe, particularly in Germany and England. It was manufactured in a small way at Bergen, but the invention is so recent that the business of making the barrels is not yet much developed in Norway, where the introduction of new enterprises must necessarily meet with many obstacles.

Fish culture. Although the question of increasing the supply of food fish by artificial propagation is apparently one of much consequence to a country like Norway, which depends so much upon the industry of fishing, comparatively little attention has been given to it until recently; now there is only one Government hatchery, and despite the important work performed in this there is no small amount of prejudice in certain quarters against the expenditure of public money for such a purpose. This prejudice is all the more surprising in view

of the fact that it exists among some of those whose business prosperity depends upon the success of the fisheries, and also because the results of well-conducted fish-cultural operations have been sufficiently demonstrated in various countries during recent years to indicate that the experimental period has been passed and the stage of certainty of attainment has been reached.

The hatchery referred to is at Flodevigen, near Arendal, on the south coast of Norway, and it was designed and erected for the purpose of breeding sea fish, particularly the cod. Photographs of the hatchery, showing the exterior and interior were exhibited (Pls. XXIV, XXV, and XXVI), and also a working model of the apparatus used, together with specimens of young cod of various ages.

The output of this hatchery reached the enormous total of about 400,000,000 cod fry in 1898, with a maximum expenditure not exceeding $2,500—the Government appropriates $2,350. This, together with the additional fact that the hatching apparatus, as well as the system for collecting eggs, differs materially from anything tried in the United States, seems to warrant a somewhat extended mention of the hatchery and the methods pursued. The description of apparatus and methods is based on a free translation of the account written by Captain Dannevig, the superintendent.

The original hatchery at Flodevigen was built, at the suggestion of Captain Dannevig, in 1884, by the Arendal branch of the Society for the Promotion of the Norwegian Fisheries, and with the object of ascertaining whether it was possible to produce large numbers of fry of the better class of salt-water fish at a reasonable cost, the decrease in the fisheries, especially in the cod fishery, being then greatly felt.

The work commenced in February, 1884, and as neither methods nor serviceable apparatus for hatching the floating eggs of salt-water fish were then invented, many difficulties had to be overcome, and the first four seasons were, generally speaking, spent in making experiments, the whole quantity hatched during the period being only about 100,000,000, and the cost of production 4 pence per 1,000 fry.

In 1890 the hatchery was rebuilt after a new and improved plan and considerably enlarged.

The site of the hatchery is on a little bay at Hisoen (His Island), about half a mile from the North Sea, and the same distance from the town of Arendal. In spite of its close neighborhood to the sea, Flodevigen is well protected against storms and rough waves by small islands and rocks, so that even small boats can lie safely at the wharf at all times of the year. The sea water is clear and clean, as it generally is along this part of the Skagerack coast, notwithstanding it may at times get somewhat mixed with fresh water from Nidelven (Nid River), which surrounds three sides of Hisoen. This does not, however, seem to have any apparent influence on the salinity of the deeper

FRONT VIEW OF FLODEVIGEN COD HATCHERY

Photographed by H. P. Neilsen.

water from which the hatchery gets its supply. The depth in Flødevigen, where the suction pipes are placed, is 8 to 9 fathoms, and there is an increase in depth nearer "Thorungerne," which is here the outermost of the group of islands. The sea bottom slopes gradually downward from Thorungerne, so that the depth is 100 fathoms not more than four English sea miles distant. From this the slope continues down to the 450 fathoms deep channel, which cuts off the coast from connection with the shallow and still rich fishing grounds on the opposite side of Skagerack. This strip of ground, with its natural protection of islands, banks, and deep channels, makes an excellent fishing bank, which until the first half of this century literally swarmed with edible fish. Between the islands and the mainland there are many fjords, bays, and sounds, which constitute a most excellent home for the non-migratory species of fish, and besides possesses the great advantage that the fisheries can be prosecuted there in all kinds of weather. There is also another circumstance which makes this strip of coast adapted to the fry that may be let out there, namely, the current, which is so weak that there is no danger of the fry being driven out to sea in the beginning of its development. Prof. G. O. Sars has been there on several occasions to study the conditions at this place, and in his report to the Storthing he says:

> The result of my investigation is that the ground on the whole must be said to be very good for cod at all ages. I have also found the sea fauna rich and varied, which means nourishment enough for many times the present quantity of fish.

Even if the strip of fishing ground protected by the deep channel may be said to be very well adapted to support a large quantity of fish, at the same time, on account of its limited extent, it may very easily be fished out, so as to deplete it of fish. The increase of the population in the surrounding districts in the beginning of the fifties brought on a larger demand, as far as the daily fisheries were concerned, and as a consequence there was a decrease in the quantity of fish to such a degree that there was fear of entire destruction. The feeling concerning this was so general that when, in 1882, the proposal was made to erect a hatchery for salt-water fish it met with the greatest approval. The old hatchery which was started in 1884 was almost entirely erected by private subscriptions, and was intended for a trial hatchery where one, besides the largest possible production, had especially to gain experience, so that a larger plant in the future might be erected on as practical and economical a plan as possible.

The new establishment, like the old, is erected within the angle formed by the two salt-water basins belonging to the hatchery, in such a manner that by aid of two short pipes it can be put in connection with these.

The hatchery house (Pl. XXIV) is a wooden building 65 feet long and 34 feet 6 inches wide. Two-thirds of the length of the building

has one story with cellar and loft; the remaining third has two floors. The first floor is one large room, where the hatching apparatus is placed in three rows. Between the rear wall of the building and the basin wall, and 3½ feet higher than the floor of the main building, is erected a smaller building, where the filtering apparatus is placed. In this room is also a water wheel, the purpose of which will be explained later on. From the hatching room a stairway leads up to the loft and to the second story. One part of the second floor is used for the manager's office and the other for the workroom of zoologists. The basement floor contains two large wooden boxes in which the water that has been used is, by aid of gutters, conveyed under the floor. These boxes are connected by special pipes with two ship pumps in the engine house.

Connected with the hatchery, and constituting an important part of the fish-breeding establishment, are two small ponds or basins, filled with sea water, where the breeding fish are confined until they shed their eggs naturally; for by the system conducted by Captain Dannevig no attempt is made to spawn fish artificially, for he claims that he can get a much larger number of eggs by the method adopted, and also that a greater percentage of them will hatch. The ponds referred to are designated by him as the spawning basin and breeding basin. The former is the smaller of the two, and is 61 feet 9 inches long, 19 feet 6 inches wide, and 9 feet 9 inches deep. It is surrounded on three sides by solid stone walls, while the fourth is formed of a steep mountain wall. It is supplied with a roof of boards (Pl. XXV) to protect it against the snow, and also as a shade for the strong daylight, which otherwise would affect the fish. About 2 feet from the bottom a wooden floor is placed, with an opening between the slats of 1 to 1½ inches. Under this is a network of pipes, with outlets through the wall, for carrying off the impure water which gathers in the bottom on account of the excrements, waste food, etc. As the floor is visible through the clear water, the dead fish may easily be removed. The basin has room for 1,000 to 2,000 large fish, but the water must be renewed continually.

The breeding basin is 110 feet 6 inches long, 71 feet 6 inches wide, and 16 feet 3 inches deep. Two sides are formed by thick solid-stone walls, the other two sides by the natural mountain walls. The basin has no roof, and is consequently exposed to all kinds of weather. It was originally put up for breeding fry, but being hemmed in so closely between the hatchery house and the rocks, the wind has much less strength than before to set the surface of the water in motion, and therefore it is less suitable for breeding purposes. It will in future be used principally as a reservoir for salt water, necessary for operating the apparatus, and in the summer for production of oyster fry. The eggs discharged by the cod in the spawning basin float at the surface, and are automatically collected by an apparatus specially

COVERED COD-SPAWNING POND IN REAR OF HATCHERY.

Photographed by H. P. Neilsen.

devised for this purpose, the outflow of the water being utilized to accomplish the work.

This apparatus is located in the loft in the east end of the building, and consists of a trough 4 meters long, 1 meter wide, and ¼ meter deep. It has one of its ends fastened in the basin wall, while the other end enters a box somewhat wider and deeper than the trough. The whole is placed horizontally, and kept absolutely waterproof; the box must be considered a continuation of the trough. From the box extends another small trough to the breeding basin, having its opening above the water wheel, which supplies the necessary water. In the box is placed the particular apparatus which collects the roe. It consists of a large strainer covered on the bottom, on two sides, and one end by fine haircloth. The open end turns toward the trough, and is pressed tightly to its edges. It will easily be understood that the floating roe, which is carried by the current into the gathering apparatus, must remain in the strainer, while the water continues on through the trough. All that remains to be done is to transfer the eggs from the collector to the hatching boxes.

Steam power is required to fill the ponds and keep up the necessary circulation of water. For this reason an engine house, 26 feet long and 13 feet wide, was built west of the hatchery and parallel to it.

It has a 3-horsepower steam engine, which is in operation continually during the hatching season. In the summer time, when only the water in the basins needs replenishing, the engine is not used, but there is a windmill behind the engine house, attached to a high iron brace, and so arranged as to be put into connection with the axle joints in the engine house. In the engine house is also placed a double-acting force pump, which gives about 10,000 liters of water per hour, and a smaller force pump and two ship pumps. These different pumps, either individually or collectively, can be put in motion by the engine, which, in the last-mentioned case, works under a pressure of about 50 pounds per square inch.

A pipe about 1,000 feet long leads the fresh-water supply to the steam boiler. From both of the ship's pumps, galvanized pipes lead down to the tanks on the cellar floor of the hatchery; from the other two pumps the suction pipes go into the sea, and out to a depth of 8 to 9 fathoms. At a height of 3.8 meters above the engine-house floor is placed a trough 30 centimeters wide, into which all the pipes empty their water. The trough is divided lengthwise in the southwest corner of the hatching house, where the two different water courses part, one continuing in the same direction to the spawning basin, the other, also in a closed trough, running past the western wall of the main building, to the breeding basin.

In addition to the fish in the basins others are kept in tanks or live-cars underneath a wharf 65 feet long and 13 feet wide, which was built for this purpose; it has 21 feet of water at its deepest end and

12 feet at its inner or shallowest end. It contains three large tanks, about 10 feet square, and two smaller ones. Numerous openings are made in the tanks, so that the fresh sea water may run in and out. The fish seem to thrive very well, when they are properly fed. The tanks are made so that they can easily be lifted out and repaired, and also be cleaned of destructive worms, which in a short time would destroy the woodwork. For this purpose the tanks are taken up every spring—when the spawn fish are put into the spawning basin—and are left out in the cold air, so as to kill any live germs which may have accumulated on them. The three tanks will hold about 1,000 cod of different sizes.

It has been a part of the system to keep the fish from one season to another, but in order to do this successfully it was found necessary to have an ice house and freezing apparatus. Without this plant it was difficult and even impossible to obtain the food needed for the roe fish when these are kept from one year to another.

Therefore, inasmuch as a regular and certain supply of nourishment is required to keep the fish in good condition, the cheapest and surest means of securing this was to erect an ice house, with freezing apparatus, so as to always have on hand in a frozen state the fresh herring bought during winter. The freezing apparatus, which occupies a space of about 200 cubic feet, holds 25 barrels of herring, which seems sufficient for summer consumption. These are placed in the center of a 1,300 cubic-feet ice depot.

The hatching boxes, as previously stated, are different from anything used in this country, and the system of circulation by which they are operated is unlike anything adopted in the United States and seems well adapted to hatching many species of sea fishes. In regard to its arrangement, the apparatus is the same as has been used since the hatchery was built, and Captain Dannevig believes it is the best and most reliable of its kind. At the time the hatchery was remodeled and extended he says:

A great many new kinds of apparatus were needed, and there would then have been a good chance to try one of the newer systems, but after having made myself thoroughly familiar with these, I did not venture to make any changes, and later on, after I had had opportunities to confer with foreign scientists, I have had no reason to regret that I did not make changes.

Under favorable circumstances our apparatus is able to hatch up to 90 per cent, and it is hardly possible to reach higher, with the tender, delicate cod roe. Two liter of roe is used per each cubic foot of water, and the roe is kept in a constantly whirling motion, so that it has no chance to lie still, either on the bottom or on the surface.

The hatchery has 42 sections of apparatus, with an aggregation of boxes, in each of which may be put 1½ liters of roe, or a total of 500 liters. If the work begins early in February, and there is a sufficient number of roe fish, the apparatus may be filled twice, which means 1,000 liters. After the last counting, I found 456,000 eggs per liter, which indicates a possible total of 456,000,000 cod eggs in one season.

The hatching apparatus (fig. 49) is 8 feet long, 2 feet 3 inches wide, and 12 inches deep. Its whole length is divided into two even parts, and each of these is divided into seven sections by crossbars, of which five are 15 inches long, and the other two 6 inches each. The apparatus is divided into ten large sections, C, and four smaller ones, D. Each of the first-mentioned ten are waterproof, while the four smaller, 2 by 2, are connected by an opening in the long side by B; the upper two sections (farthest to the right on the illustration) serve as receivers for the water coming from pipe E, and the lower two receive the water after it has passed through the boxes, and discharge it into the waste-pipe F.[1]

In the larger spaces, of which each apparatus (as formerly mentioned),

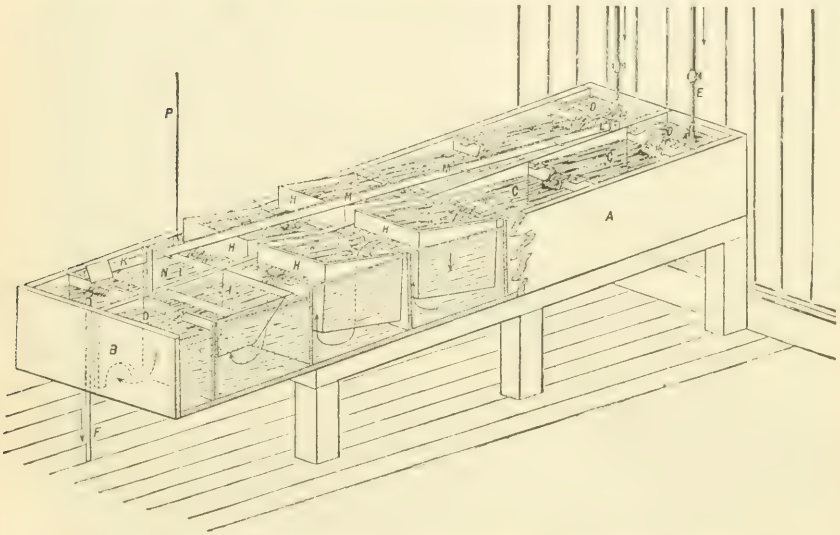


FIG. 49.—Dannevig cod-hatching boxes in operation. (After Captain Dannevig.)

contains ten, the hatching boxes for the floating eggs of cod, flounder, etc., H, or lobster, I, are placed.

The hatching boxes (fig. 50) for floating eggs are 12 inches long, 10 inches wide, and 10 inches deep. The sides are made of five-eighth-inch boards; the bottom is of haircloth so fine that it can retain eggs and fry, and at the same time allow the water to run out.

The little boxes which are placed in the large room are fastened by the upper edge to the nearest cross partition by leather hinges, A A (fig. 51). In each partition is a cut about 3 inches long and three-quarters of an inch deep, in which is placed a spout of galvanized iron, B, and in the corresponding edge of the little box is placed a similar

[1] Owing to a mistake, the upper end of the waste pipe shows on the illustration above, instead of a couple of inches below, the surface.

spout, C, but of much larger size, so that it projects and extends outside the first mentioned, both on the sides and underneath.

By looking at fig. 49 we will see how the circulation takes place. When the water runs into the apparatus, through pipe E, the two upper small compartments fill up on a level with the lower edge of the spout, through which the water next passes into the nearest larger section C, and thus continues to run until the whole apparatus is filled; the superfluous water is carried off through waste-pipe F.

The apparatus slants one-fourth of an inch per foot, which makes the stream of water run quicker as long as the water supply through pipe E takes place with sufficient speed — about 500 liters per hour — for each apparatus.

In figure 49 a piece of the side wall of the apparatus is removed, to show how the circulation takes place in the hatching boxes. It will be noticed that when the larger spaces are filled with water, and the little boxes inside of these spaces are fastened only at one side, the boxes will naturally float up against the opposite side, and consequently get into a slanting position, as shown at H H (fig. 49).

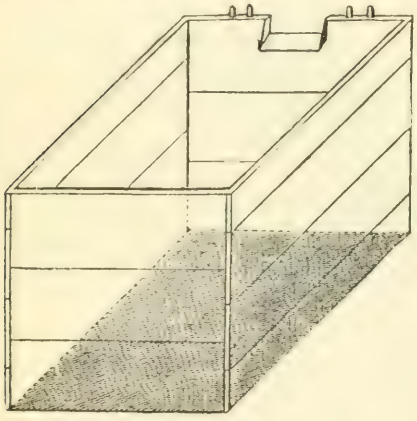


FIG. 50.—Dannevig cod-hatching box. (After Captain Dannevig.)

When the water from the space above streams through the spout into box H, and this, as well as the space in which it is placed, is filled, the circulation will begin under the continuous run of the water. The water jet has speed enough to reach the net on the bottom of the box, but instead of going through the net, it follows in the same slanting direction, until it meets the side wall of the box, which it follows up towards the surface and back towards the starting point. The whole mass of water thus gets into a whirling motion, in vertical directions, at the same time, as the superfluous water runs through the bottom of the box, and through the spout into the next box, and so on, through the whole apparatus.

If the apparatus is clean — which is absolutely necessary for the hatching to prove successful — and the water sufficiently salt, the motion in the water itself will separate the eggs from the bottom.

If the water loses enough of its salinity so that its specific gravity is less than the weight of the eggs (1,022) the latter go to the bottom and into the "dead corner," right across from the inlet. To prevent this, which practically means the destruction of the eggs, there is

INTERIOR OF FLODEVIGEN HATCHERY, SHOWING COD-HATCHING BOXES IN OPERATION.

Photographed by H. P. Neilsen.

fastened on each apparatus an arrangement which may be described as follows:

In the illustration (fig. 49) will be noticed an iron rod, K L, which, at L, is fastened in such a manner to a fork-shaped vertical beam placed in the center of the middle wall of the apparatus that it can move on the bolt, with L as a central point.

In this iron rod is placed a cross bolt, M, which is long enough to project across the upper edge of a box. By looking at the illustration one will observe that the boxes, H H, which are opposite each other, are far enough apart so that the iron bar can pass between them down to the central partition. The cross bolt prevents this, however, by stopping it at the upper edge of the boxes, and as the bar has sufficient weight, it causes the free ends of the boxes to be pressed deeper down into the water, but they will again float up when the iron bar is lifted at K. The string, P, which is fastened to the bar, has its other end attached to the water wheel in such a manner that it rises

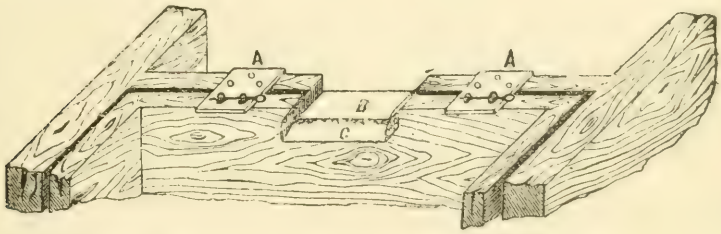


FIG. 51.—Hatching box attachment. (After Captain Dannevig.)

and falls twice every minute. The motion is, however, not regular. The rise takes place very slowly, while the fall comes suddenly. At N is a split vertical beam, or guide, in which the rod moves.

As the bottoms of the hatching boxes consist of haircloth, and as the space in which these are placed is full of water, it will easily be understood that when the box is pressed down the water will rise through the haircloth, and at the same time the eggs, which may have sunk to the bottom, will rise, and these will again be whirled around in the box by aid of the current.

The circulation of water is effected as follows: From the engine house two pipes lead down into the sea and are continued along the bottom until a depth of 9 fathoms is reached. These pipes are connected with the suction pump and press pump in the engine house. Pipes lead from these up to the large wooden trough which receives the salt water. This trough continues through the wall of the engine house to the southwest corner of the hatching house, and is divided lengthwise, so as to form two separate water courses. One of these continues along the south wall of the main building to the spawning basin, while

the other runs along the west wall to the breeding basin, which now is used as a reservoir.

By continuous pumping through the first of these water courses the spawning basin, where the roe fish are, gets filled and the superfluous water will run out through the trough which leads into the collecting apparatus, carrying along on the surface the floating roe which, as already mentioned, gathers here and may then be obtained very easily.

After the water has thus done its double service, first, to supply the spawn fish with the necessary oxygen, and, next, to carry the roe into the gathering apparatus, it is led onto the wheel which puts into motion the levers placed over the hatching boxes. This gives a considerable power, which otherwise would have to come from the engine, and it also enables one to regulate the speed without regard to the unavoidable temporary stops and irregular motions of the engine. As the same water volume will be used again in certain cases, it is of the greatest significance for it to absorb all the air possible, and this is accomplished by carrying it over the wheel. After this it runs out into the box placed under the wheel and forms several little waterfalls before it reaches the large tank in the cellar, from which it is pumped up again into the spawning basin, to take the same return run. For partly renewing the water in the spawning basin one of the press pumps in the engine house is used and is kept continually pumping water from the sea.

The other water course runs along the west side of the main building to the breeding basin, into which it empties the whole volume of water. From this basin the water runs in pipes through the wall into the filtering house, where it gets distributed into five filtering boxes which are connected by communicating pipes so that the water reaches the same height in all of them. The filtering is done by letting the water run through three frames covered by flannel before it comes into the boxes. These frames, sixteen in number, need constant attention, as they generally are changed and cleaned four to six times an hour.

From the filtering boxes the water runs through galvanized-iron pipes to the hatching house, in which is placed small faucets along the walls and in the middle of the floor, for the purpose of carrying the water into the hatching boxes.

After running through these it is led through a trough under the floor to a box in the cellar, from where it may be pumped back into the breeding basin by the other ship's pump in the engine house. The suction and press pumps already mentioned pump fresh sea water steadily for replenishing the supply.

The purpose of this double water circulation is to prevent the usage of the same water for the hatching boxes, for that which has been

used in the spawning basins often becomes unclean, especially from the effects of fat or from the excrements of the fish. This uncleanliness will easily spoil both eggs and fry if not attended to.

SWEDEN.

Commissioner.—The commissioner from Sweden was the well-known authority on fish and fisheries, Dr. Rudolph Lundberg, who is the superintendent of fisheries for Sweden and a member of the royal board of agriculture. Dr. Lundberg has written extensively on the Swedish fisheries, and his knowledge of them is concededly comprehensive and accurate.

General considerations.—The fisheries of Sweden, though of less importance than those of Norway, are, nevertheless, of much consequence to a large element of the coast population, and serve to supply the nation with much useful material for food and other purposes.

The Swedish fisheries have fluctuated considerably, due to the periodical visitations of the herring to the coasts of the southern provinces, for periods of exceptional abundance and prosperity have been followed by years of absence of fish and consequent depression painful to witness. So great has been the influence wielded that, in his History of Gottenburg, Granberg has ascribed its prosperous condition in the closing years of the eighteenth century "to its East Indian trade and the herring fisheries."

The Rev. O. Lundbecks, writing in 1831, graphically depicts the evil of the absence of herring from the southern coast and the consequent decline of fisheries and distress of the inhabitants. "He who knew the coast of Bohuslän twenty-five years ago," he writes, "and now sees it again, will scarcely be able to refrain from tears. Then it presented an imposing appearance. From the sea itself rose massive walls and pillars supporting immense salting houses and oil refineries. Farther inland rich warehouses and busy workshops might be seen, as well as palatial residences of the merchants and neat cottages of the fishermen and workingmen. The coast was crowded with a busy throng and the sea studded with sails. Every night it looked as if there were a grand illumination, many thousand lights shining from the windows and from the numerous lamps along the quays, and being reflected in the waves. Everything was life and bustle, and tons of gold changed hands. Now nothing is seen but ruins, only here and there a dilapidated fisherman's cottage, awakening melancholy thoughts in the heart of the visitor. Would that these glorious times for which thousands are sighing might return."

A new herring period began in Bohuslän in 1877 and, although the catch has fluctuated considerably since that time, it was uniformly large for the nine years ending in 1896, the winter catch always exceeding

1,000,000 hectoliters[1] each season during that period, according to statistics given by Dr. Lundberg, and on two occasions, the seasons of 1893–94 and 1895–96, being in excess of 2,000,000 hectoliters. In the last-mentioned year it was 2,372,051 hectoliters, with a value of $592,087.

"During 1895–96 no less than 10,741,848 kilograms of fresh herring were sent by rail from Gottenburg and Uddevalla." During the period from 1891 to 1895 the amount of herring salted in Bohuslän ranged from 344,546 to 418,614 barrels yearly. In addition large quantities were manufactured into oil and guano.

In Introductory Remarks on the Fisheries and Fishery Industries of Sweden, Dr. Lundberg presents the following facts which are of more than ordinary interest:

The Kingdom of Sweden, which forms the eastern and larger (58 per cent) portion of the Scandinavian peninsula, extends from 55° 20′ 18″ N. to 69° 3′ 21″ N. (a distance of about 14° of latitude) and has an area, including the islands, of 442,126 square kilometers (170,660 square miles). Of this area the lakes make up 36,281 square kilometers (13,900 square miles), or 84 per cent;[2] the length of our seacoast, omitting that of the many bays and fiords, is estimated at 2,500 kilometers (about 1,550 miles). It is clear that, under these circumstances, fishery ought to be an important industrial source for the population of the country. The importance of the fishing industry would be yet greater if our seas were as rich in fish as our coasts are extensive, but unfortunately such is not the case. But the fisheries are, nevertheless, of considerable importance for our population, of whose total of 5,000,000 about 50,000 may be said to depend directly on the fisheries for their support, while fishery forms a not unimportant by-industry for a considerable number of other people, both on the seacoast and along the shores of the innumerable lakes of the country. Besides this, our fisheries are doubtlessly capable of further development in proportion as the extension of our systems of communication increases the opportunities of a lucrative disposal of the fish, and when our population has gained a clearer insight as to the value of the fisheries—especially of the lake fisheries—if only proper attention be paid to them.

The seas that wash our coasts are, beginning from the north: The Gulf of Bothnia and the Baltic, which, on the Swedish side, is joined by means of the Sound with the Cattegat and the Bay of Bohus, which are connected with the North Sea by means of the Skagerrack.

The deep (600–800 meters) gully called the "Norwegian Channel," extending along the Norwegian coast in the Skagerrack, ends at rather a good distance from the Swedish coast, the depth in the Bay of Bohus only occasionally exceeding 200 meters; in the Cattegat a deeper gully or channel (50–100 meters) runs southward along the Swedish coast down to the island of Anholt, but with that exception the Cattegat is not more than 50 meters deep. On the west coast, especially, there are banks of great importance for fishery.

The sound also is deepest in its northern part, and a rather deep channel (but one not reaching to 50 meters) is found there till we come a little to the north of Malmo, where a bank only some few meters deep begins.

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[1] A hectoliter is 26.42 gallons, nearly equal to the capacity of an ordinary fish barrel.

[2] This is evidently a typographical error, since the area of the lakes is only a fraction in excess of 8.2 per cent of the total area of the country.

The Baltic, too, is a fairly shallow expanse of sea, but, besides the great shallow banks (as that between Skane and the German coast, that south of Gotland, etc.), there are also very extensive tracts of from 100 to 200 meters in depth, and occasionly depths (as between Gotland and Kurland and south of Landsort) of 300 or even over 400 meters—the deepest in the Baltic—have been reached. The Baltic, properly so called, is separated from the western Baltic by a bank which follows a line running between the entrance to the Sound, Falster, and Doesserorts; and to the north from the part known as the Sea of Åland (Swedish "Ålands haf") by a similar submerged bank between the coast-archipelago of Stockholm, Åland, and the Finnish coast-archipelago. The Sea of Åland is similarly divided from the Sea of Bothnia, or the southern portion of the Gulf of Bothnia, at the South Qvarken. A broad bank, at the North Qvarken, separates the Bothnian Sea from the northernmost part of the Baltic, or, as it is termed restrictively, the Gulf of Bothnia. The latter is, near the coast, almost exclusively shallow, with but a few places where the depth is over 100 meters. One can see upon charts giving the various depths, how the mud carried down into the Baltic by the full-flooded rivers (especially in its northern portions,) has been deposited in mighty banks, not only near the coast, but also at a considerable distance out to sea.

The influence of currents on the appearance and sustenance of fish is a matter to which Dr. Lundberg devotes much attention. He says:

These enormous bodies of water which are conveyed to the Baltic, give rise to an almost always continuous current from the Baltic through the Sound and the two Belts out into the Cattegat, the varying rapidity of the current being dependent upon the water-mass of the tributaries at different seasons of the year and upon the winds. This current flowing out from the Gulf and the Sea of Bothnia has there a preponderant north or northeast direction; at its entrance into the Baltic, properly so called, the north current from the Sea of Bothnia meets with the northeasterly currents from the Gulf of Finland, and these uniting, give rise to a northeast current which flows by the coast-archipelago of Stockholm and goes down between Gotland and Öland with a branch going through Kalmar Sound, and also to a more northerly current which passes between Gotland and Kurland. The two currents unite south of Gotland and Öland, forming an east-northeast current which flows round Bornholm in two branches and flows out in two branches between the Sound and the Belts into the Cattegat. The current through the Sound conveys chiefly Baltic water, and this current afterwards continues along the Swedish coast as a slightly-salt surface current into the Bay of Bohus and then along the Norwegian coast to about as far as Bergen.

A bottom-current of salter and heavier water enters the Baltic simultaneously from the North Sea through the Skagerrack, the Cattegat, and the Belts, and this stream can be plainly traced chiefly along the southern and eastern coasts of the Baltic as far up as to Ösel and to the Gotska-Sandö, after which it disappears. The salter water which thus flows into the Baltic comes mostly through the Great Belt, while the outflowing fresher Baltic water passes both through the Sound and the Belts. The Baltic water issuing from the Belts is, however, much salter than that going out through the Sound.

The seas surrounding Sweden thus show from Skagerrack up to the Gulf of Bothnia a continually decreasing saltness which finally almost approaches that of fresh water. * * *

It is to be noted that it is not alone the small salt-percentage of the water but also its coldness that contributes in equal degree to give the Baltic the biological character it displays when compared with the adjacent seas, in sharp contrast especially with the fish-swarming waters of the North Sea. * * *

This is of importance from a biological point of view, which is shown by the fact that salt-water fish in many cases were found to go farther north along the Finnish

coasts, in the same way that several species of fish belonging to the western Baltic, but which are not found on our Baltic coasts, go to a considerable distance eastward along those of Germany.[1]

In the most recent work on the subject, published in Sweden, by F. A. Smith, the author claims there are 175 different species of fish in Sweden or off its coasts. Of these 135 are salt-water fish, and the other 40 species embrace fresh-water fish, anadromous and migratory species. Sixty-five of the salt-water fish are considered only as occasional visitants to the Swedish seas. Only about 23 species of sea fish occur commonly in the south part of the Sound and off the south coast of Skâne, and only about 12 species can be reckoned as occurring more or less generally in the northern Baltic. The influence of prevailing conditions in the Baltic are noticeable in the herring particularly, which is smaller off the northern coasts than in the seas off southern Sweden, and is called "strömming."

The differences found in our fish-fauna and in its biological conditions on different parts of our coasts, says Dr. Lundberg, naturally affect the fishery carried on there, not only as regards the fish-species which are the object of the fishery, but also in the question of returns and of the methods of fishing. It is to be noted, however, that in the last respect the coast-conditions are of great importance. It is not, for example, merely an accident that, as we shall see, deep-sea fishing with drift-nets is carried on almost exclusively in those parts where the coast is open, and wanting in that girdle of surrounding islands which we call the "coast-archipelago." Attempts to introduce drift-net fishing in other places have not been crowned by any real success, neither has it succeeded in ousting the other forms of fishing previously in use.

Another condition, distinctive for our fisheries in contrast with the fishery for example in the North Sea, is that the fishermen themselves are owners of the boats and fishing-tackle and divide the returns in proportion to each one's share. Ship-owners or companies carrying on fishery with hired crews are not yet found in this country.

The species of fish that here are the object of the fishing are: The herring first of all; many species of cod and flat-fish, the mackerel, etc.; the salmon, the eel, and a great number of other fresh-water fish.[2]

Comprehensive figures of the Swedish fisheries are not available, but the following statistical statements relative to some of the more important branches of fishery may prove interesting, since they convey an idea of the magnitude of these industries:

In 1895 the herring fisheries of Bohuslän employed 7,536 men, 18,632 gill nets, and 331 seines. Of the gill nets, 4,358 were used in drift fishing and the balance were set or standing nets, anchored near the shore. The boats employed in the drift-net fishery numbered 146, but no record seems to have been made of the boats used in operating seines and set nets. The results of this fishery have already been given.

The so-called Sound herring fishery yielded a product, in 1897, valued

[1] Fisheries and Fishery Industries of Sweden, by Rudolph Lundberg, Ph. D., pp. 1–5.
[2] Ib., p. 11.

at about $116,993. The herring fishery of Blekinge yielded a value of $45,333 in 1896, but in 1894 it amounted to $88,155. The Gotland strömming (small herring) fishery reached a total of $74,047 in 1896. It is estimated that this fishery in the government district of Gefleborg has an annual yield of about $54,000, while in Westernorrland it reached a total, in 1895, of $70,857. The sprat fishery of Bohuslän yielded $10,605, though this amount was below the average for six years, the highest of which was 1891, when the value reached the sum of about $24,107.

The yield of the deep-sea fishery for cod, etc., including that carried on in the Cattegat, amounted to $133,875 in 1896, when 218 vessels, with an aggregate tonnage of 4,423 tons, and crews numbering 1,716 men were employed in this industry.

In the same year the codfishery of the province of Malmöhus produced 729,510 kilograms of fish, valued at $34,110.

There are no statistics of the codfishery for the east coast of Skâne.

In the province of Blekinge, however, the returns for the codfishery show a catch for 1896 of 1,520,000 kilograms, with an aggregate value of $29,545. As we proceed north the importance of the codfishery declines, and in the province of Kalmar, which adjoins Blekinge on the north, only 62,600 kilograms were given as the catch in 1894, with a value of $4,225. But the codfishery industry of the island of Gotland is of greater consequence, due probably to the fact that it is farther out in the Baltic. In 1896 it produced 562,700 kilograms of fish, worth about $15,193.

The statistics of codfishery given above include species of the Gadidæ besides the cod, such as the haddock and whiting; the fishery for the latter is not important. Large numbers of coal-fish (*Gadus virens*) are sometimes taken off the southern coast with hand-lines, and quantities of hake are caught on some of the banks west of Oskar during the midsummer herring season.

The flat-fish fishery is of considerable consequence, for from the district of Malmöhus alone the catch for 1896 in the Baltic, the Sound, and the Cattegat reached a total value of $28,216; in Blekinge, $13,824; Gotland, $4,426; and in South Kalmar it is estimated at $1,422.

The yield of the mackerel fishery of Bohuslän, from which province alone it is prosecuted, amounted to 993,305 fish in 1896, with a value of $36,143. That year 520 boats engaged in the fishery.

The total catch of lobsters in Bohuslän and the adjoining province of Halland was 301,920, worth $49,711. There has been a decline in the oyster fishery, which in the period from 1869 to 1878 yielded 670 baskets of 200 oysters each, with an aggregate value of $2,976, but in 1896 the returns show only 94 baskets, worth $792.

The eel fishery is important. For the year 1896 the product in

Skåne and Blekinge amounted to a total of 274,730 kilograms; value, $62,862.

There are no figures for the district of Christianstad since 1883, but in the period from 1879 to 1883 the average annual catch was 96,705 kilograms of eels, worth $24,300. The total value of the salmon catch of Sweden in 1896 was estimated at $106,547.

While the statistics given cover the most important branches of fishery, various other species of fish are taken in small numbers, but sufficient, perhaps, to make them of some importance to the fishery industry of Sweden. Among these may be included the pike (*Esox lucius*), perch (*Perca fluviatilis*), roach (*Leuciscus rutilus*), gwyniad (*Coregonus lavaritus*), and ide (*Leuciscus idus*). According to Dr. Lundberg, the returns for 1897 showed that there were caught 67,230 kilograms of pike, 77,320 kilograms of perch and roach, and 14,030 kilograms of gwyniad and ide. He says that "in southern Kalmarlän the catch of these kinds of fish amounted in 1874 to 209,870 kilograms, with an estimated value of 56,257 kronor."

The foregoing figures, while they may serve to indicate the extent of sea fishery, aside from references to a few fresh-water fish, do not embrace the lake and river fisheries which, in a country having so many lakes and streams as Sweden, must be of some consequence. There are, however, no complete statistics covering the catches made in fresh water.

Concerning the disposition of fishery products, and especially the exportation of fish, I venture to quote the following from Dr. Lundberg's paper:

In former days the trade in fish was limited chiefly to dried or salted goods, the slow means of communication of the times not allowing of the transport of fresh fish to any great distance. Increased and quicker communications have led to a great change in this respect, although the long distances and the consequent heavy freights still hinder the development of the fish trade. Respecting the herring of the government district of Bohuslän, which is caught during the late autumn and the winter, in consequence whereof the fish can bear transport to fairly long distances, reduced rates have been allowed on the State railways when whole wagon loads are sent, and as a result the fresh Bohus herring is nowadays sold in almost every part of the country where railways are found. Fresh fish in general may, on certain conditions, be sent by the day express trains at the same rate as for freight goods, but this may be done only exceptionally by the night expresses. Salted herring and strömming forming a part of the daily food of the working population of the country, a considerable amount of such fish is consumed; even in former times, when the population was far less than now, salted and dried fish was imported from Norway, and salt strömming and salmon from Finland. Even to-day these countries are our chief sources of import for these goods. From Finland, especially from the island group of Aland, there are imported, besides salt strömming, living fresh-water fish such as pike, etc., to Stockholm. For this transport there is used a kind of boat with a well room, called "Alands sumpar,"[1] and the same kind of vessel is used on the Swedish

[1] For details of this craft see description of Stockholm welled boat, p. 192.

coast to transport living fish from the coast archipelago to Stockholm from as far south as the government districts of Östergötland and north Kalmarlän.

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Sweden's export of fishery produce has long been unimportant and much below the imports in extent. A great change has occurred of late in this respect, so that in question of quantity as regards the export of fishery produce, Sweden now holds one of the foremost places.

To this the very important export of fresh Bohus herring has largely, though not wholly, contributed.

While the export in 1876 did not amount to 1,000,000 kilograms, in 1894 it reached not less than 134,000,000 kilograms. Fresh herring has, as we have before mentioned, had the chief share in this increased export, but the export of salt herring has also considerably increased from what it was in the seventies.

Salmon, chiefly in a fresh state, has long been exported—partly to England, partly to Germany. During the last few years an export has arisen of other fresh-water fish, such as pike perch, etc., to the last-named country, besides which, German fish dealers buy living eel and other species of fresh-water fish along the south and east coasts of the country. A little salt salmon is exported to Germany for the smoke-curing establishments.[1]

The total value of all exports of fresh fish in 1896 was $1,386,915. Of these 65,663,730 kilograms were fresh herring, with a value of $886,460, and 2,059,487 kilograms of other kinds of fresh fish, worth $500,455.

The total value of all kinds of fish products for the three years ending in 1896 were as follows: 1894, $2,303,533; 1895, $2,163,255; 1896, $2,056,758.

The exhibit of Sweden, in addition to material of private exhibitors, embraced rich collections of models of boats and fishery apparatus from the Fishery Museum at Stockholm, fishery apparatus from the Gothenburg and Bohuslän Agricultural Society, and collections of sea and fresh-water fish and animals, eggs and fry, maps, etc., from the royal board of agriculture at Stockholm. Taken as a whole, the exhibit was comprehensive and interesting. It was located directly opposite the exhibit of the United States in the main building.

Fishing vessels and fishing boats.—In regard to its fishing fleet Sweden seems to occupy a peculiar position among the countries of northern Europe, since none of its fishing vessels are propelled by steam, so far as I could learn. It is true steam tugs may be employed in connection with its oil and guano factories to tow boats or vessels, or possibly to carry fish, but the fishing vessels proper are all sailing craft. No others were represented in the collection, and there is no printed reference to fishing steamers in the latest published accounts on the Swedish fisheries.

The fishing vessels and boats are, for the most part, sharp aft, and many of them show their Scandinavian origin. But, generally speaking, they resemble the boats of Denmark and Finland more than they

[1] Fisheries and Fishery Industries of Sweden, pp. 71, 73.

do those of Norway. This might reasonably be expected, for the fishermen of southern Sweden and those of Denmark frequent the same fishing grounds, and thus have opportunity to study the boats of each other and to adopt any features considered desirable.

The excessive hollow floor, so characteristic of the Norwegian fishing boat, is seen only occasionally in the Swedish boats, which also have no high stem and sternpost; while the square sail rig is now rare, if seen at all.

Some of the open boats are very similar to sharp stern fishing boats in New England. In recent years the tendency is to introduce vessels of the "dandy" or ketch-rig type, like those used in England, and these will probably supersede the picturesque old-fashioned bankskuta.

There are no statistics available showing the total number of vessels and boats employed in the Swedish fisheries. We have seen, however, that, in 1896, 218 vessels were employed in deep-sea and Cattegat fisheries.

In 1877 there were employed in the Bohuslän fisheries 189 bankers, 447 decked boats, and 799 open boats, having a total tonnage of 13,254 tons, and crews numbering in the aggregate 7,965 men.

The total number of boats belonging to the Skane fishing stations in 1882 was 1,581. These figures, meager though they are, suggest that the fleet is large in the aggregate.

The bankskuta.—Considered from the standpoint of size, the old-fashioned skuta employed in the deep-sea bank fisheries for cod, ling, etc., is one of the most important fishing vessels in Sweden, and until recently has held precedence in this particular, though, as has been stated, it is now being superseded by ketch-rigged cutters like the English smacks. The bankskuta has been used for many years and is decidedly the most picturesque type of fishing vessel in Sweden. It has undergone some changes in rig, and possibly in form, in the early part of the nineteenth century, and its shape has been modified somewhat in late years. The following historical notes concerning this form of vessel are based on a free translation from the Fisheries on the West Coast of Sweden, by Geohard von Yhlen:

The old schuten bankers were clumsy structures with high bows, measuring 40 feet on the keel and of 80 tons burden. They had three masts, two of which could be lowered. The after mast or mizzenmast had a fore-and-aft spritsail set on it, but square sails were set on the mainmast and foremast. Each vessel carried two small boats which were used for setting and hauling long lines. During the reign of Gustaves X more than 1,000 Swedish vessels were fishing on English banks.

About 1830 to 1840 the size of the vessels was thought to be of far less importance than their seaworthiness, and they began to build fishing craft which, with a length of keel of 26 to 28 feet, were from 30 to 40 tons burden. These vessels had their main and mizzen masts both fixed, and they were rigged with spritsail, topsail, jib, and staysail. Within a short time these innovations were abandoned and they returned to the old style of heavy schuten.

The deep-sea boats were manned with 8 men, and they made short voyages, going

out on Monday and returning at the end of the week. In the period between 1850 and 1860 the fishermen began to extend their cruises farther north and to fish upon Jäderbank. Now the deep-sea boats began to increase in size, and soon they were built with a keel 40 to 50 feet long and 50 to 60 tons burden.

In 1862 there came to the knowledge of the Swedish fishermen the great wealth of ling upon Storeggen Bank. For this fishery it was deemed necessary to build still larger vessels, and accordingly, about 1865 to 1870, a number of larger boats were built, these averaging about 70 tons each and carrying crews of 12 to 15 men.

Vessels of the present time are usually carvel-built. They are divided into four classes. First, the largest vessels, from 60 to 70 tons, with 14 men; second, those of 40 to 50 tons, with crews of 10 men; third, boats of 30 tons, which are most com-

FIG. 52.—Bankskuta.

monly employed of any, carrying 8 men in crew; and fourth small craft of 12 to 15 tons, with 5 to 6 men.

The largest of these vessels are usually sheathed with zinc, and cost from about $2,700 to $3,240.

The second size vessels cost from $1,620 to $2,160. These fish on the Jäderbank, and usually make five voyages in a season, beginning in March and hauling up in September, the catch being sold partly in Norwegian ports and partly at home.

The vessels of the third class, which are most numerous, cost from $1,350 to $1,620. They fish on all the grounds usually resorted to by Swedish fishermen, such as the reefs off Jutland, Storeggs, and Jäderbank, and even in winter also carry on codfishing. They are at sea in all months of the year except November and December. Sometimes they fish at anchor like the larger vessels, and at other times under sail.

The boats of the fourth class cost about $810 each. These fish exclusively in the

Cattegat, both summer and winter, generally using long lines. Of late years, however, in spring and summer, 36 of the boats fish with flounder trawl or ground net. Some also occasionally use mackerel nets.

All of the bankers set their lines from small boats. The vessels of the first and second classes carry two boats each, while those of the two inferior grades have only one boat apiece.

The codfishery in the time of distress, in 1808 and subsequently, was carried on only by the people of the Skargard. In 1833 this place had only 42 bankers, but in 1878 its fleet consisted of not less than 197 vessels, manned by 1,784 of the most skillful fishermen and sailors.

From 1868 to 1877, 8 vessels and 102 men were lost in this fishery. Although the Skargard, by its position, affords a good winter harbor, all except the largest class of vessels are hauled ashore in winter for the purpose of overhauling them.

While the statements made by Von Yhlen supply much interesting and useful information, they have a general application to various kinds and sizes of fishing vessels and boats. It is, however, only the larger vessels that come properly under the head of bankskuta.

Writing of the bank fishery at a more recent date (1898) Dr. Lundberg makes the following statements concerning the vessels employed:

This fishery, which is supposed to have been introduced by some Dutchmen who had immigrated to Gothenburg, is carried on, at the fishing ground situated off the Skaw, in a rather antiquated type of fishing vessel specially built for this fishery and termed "bankskutor" (bank-sloops), which are of as much as 70 tons burden and carry a crew of 14 men. Usually the boats are of 30, 40, to 60 tons burden, with a crew of from 8 to 10 men. These boats are found along the southern and central part of the Bohus coast archipelago, from Rörön, northwest of Gothenburg, to Bovallstrand on Bottnafjord, some miles south of Fjällbacka (halfway up to the Norwegian frontier). They are owned and equipped by the crews ("fiskarelag" = fishing gang), and the produce of the fishery is divided equally according to the number of the partners. A certain amount is always set aside to pay off the cost of the vessel and for necessary repairs. One of the crew is registered as being the captain, but on board the command is held by the man who happens for the time to be at the helm. Each partner owns his own fishing gear, consisting of long lines (called "backor"), which are baited with bits of herring, mussels, etc. On arriving at the fishing ground the vessel is anchored and the lines are set out from smaller boats, called "Hvässing" or "kåk," of which every sloop carries one or two, according to its size. The fishing ground is the "Jutska refet" (the Jutland reef), the "Nordvestbugten" ("Jäderen"), "Tampen" off Bergen, and since 1884 also to the north of the Shetland Islands. The Bohus fishermen once went as far north as Finnmarken (northern Norway), and for many years fishing was carried on at "Storeggen," outside Aalesund. These journeys have now ceased, but since 1894 one or two vessels have gone as far as to Iceland to fish. The deep-sea fishery is carried on from March until the middle of September, but the greater number of vessels finish that fishery in the last half of July or the beginning of August, in order to give the rest of the season to mackerel fishing with hand lines, called "dörij" in the North Sea. Ling, cod, and halibut, etc., are the produce of this deep-sea fishery. Three or four journeys are made between the fishing ground and home; the vessels that go north of the Shetlands make but one. The catch, which by the first-named vessels is disposed of at home, is sold at the more distant grounds to the buyers there, but the last catch is generally taken home. The fish is usually cured on arrival home. Part of it is salted until a brine is formed. It is then pressed, and prepared in this form has the name of "clip fish." Part is packed, half dry, in one-fourth kegs, and is

called "salt codfish," or, in a somewhat drier and less compressed state, salt ling (saltlanga). The bigger ling are cut in two. The backbone is taken out to three-fourths of its extent, after which the fish is split open, stretched on thin wooden splints, and air dried. Thus prepared the fish is called "spil-langa" (split ling).

The number of boats engaged in the deep-sea fishery proper amounted, in the years 1891–1896, to 91, 95, 97, 107, 112, and 122, respectively.

The following is a description of the bankskuta, as built a few years ago, and it is probable that this form still predominates in the deep-sea fishing fleet of Sweden:

It is carvel-built, is deep and very beamy; has a flush deck and strong sheer, the upward curve at the forward rail being materially increased by heavy, high bow-chocks. The bulwarks are low and very cumbersome, and are made by bolting thick timber togther, one piece above the other. The ends of the vessel are full and rounding at the rail, but hollowed out a great deal at and below the water line. The bow is high and flares strongly outward, the stem curves moderately near its upper part, and rakes very strongly below, meeting the keel at an obtuse angle. The floor is hollowed out excessively near the keel, the lower planks rising nearly vertical, so that there is as much as two or three feet of deadwood in height, next to the keel, above which the floor curves outward and is rather flat for about half its width, terminating in a round bilge and flaring side, the "flare" being continued to the top of the rail. The concavity of the bottom rises at either end, forming the run aft and making a scoop-shaped bow of very peculiar appearance, but which the Swedish fishermen deem it necessary to have to enable their vessels to ride out gales at anchor on the banks they resort to.[1] The body of the vessel above these concavities at the bottom and ends has a curious oval shape, not very much unlike the half of an egg which has been cut in two horizontally on the axis of its greatest length. The sternpost is straight and has a slight rake; the rudder, which is narrow and square on the foot, is hung outside, and a curved tiller is used for steering. The cabin is under deck, forward, and is entered through a low companion, aft of the windlass. The windlass is of the old-fashioned type and is worked by handspikes. It is placed well forward, near the stem; the pawl-bitt is on the port side of amidships, and only the starboard end of the windlass is used

[1] The theory that it is necessary to build a vessel so full, flaring, and high forward, to ride safely and comfortably at anchor, is undeniably a mistaken one, since a craft of this form must necessarily surge and strain very heavily on her anchor, and consequently would need heavier ground tackle to hold her than would be required for a vessel with finer shaped ends. The experience of American fishermen has taught them that the best vessel at anchor is one having at least a moderately sharp bow with a fine sheer; for example, like some of the schooners now employed in the Grand Bank cod and halibut fisheries, that ride out at anchor the fiercest winter gales that sweep the western Atlantic, and which, in this respect, are probably not excelled by anything that has ever been built.

for the hawser to pass round. The cable, instead of going through a hawse pipe, as is generally the case on most vessels of this size, passes over a roller or pulley in the stem head, which rises a little distance above the upper part of the knightheads. The top of the pawl-bit is hollowed out to receive the heel of the bowsprit; the bit is firmly braced on its forward side by a stout beam, which extends from side to side, its ends being securely fastened to the top of the bow-chocks. A heavy wooden-stocked anchor is carried. Just abaft the windlass is the heel clamp for the bowsprit. This is made of round iron, shaped something like an inverted U, with the lower ends turned out so that they will fit into stout eyebolts that are driven into the deck, while at the top or apex is a heavy iron band, into which the heel of the bowsprit ships when the latter is run out. When the bowsprit is taken in, the heel rest or clamp drops on deck out of the way. The bowsprit runs through an adjustable iron band (one end of which is held in place by a key bolt) on the top of the bow rail on the port side of the stem head.

There are usually four hatches; a small one just abaft the mainmast, aft of which is the large main hatch; still further aft and immediately forward of the pump is a second small hatch, while another, of about the same size, is abaft the mizzenmast. A sort of "horse," generally made of oak plank, extends from side to side, a few feet forward of the sternpost. This is supported by a bulkhead, in the starboard end of which is a hole to admit the end of the mizzen outrigger.

A vessel of this class carries two pole masts, the upper ends tapered to form topmasts, and a running bowsprit. The mainmast stands more than one-third of the vessel's length from the bow and the stay sets up to a heavy iron band which is fastened to the stem head. The mast is supported on each side by two rope shrouds and also by a heavy, adjustable backstay, which is set up by a whip purchase. The mizzenmast stands close to the stern and is supported on each side by a single shroud, which sets up a little forward of the mast.

There are six sails, namely, jib, fore staysail, mainsail, sprit mizzen, and square-headed main and mizzen gaff-topsails. These are usually made of hemp canvas. The jib sets flying (without stay) from the bowsprit end; the stay foresail sets on the mainstay, the upper part of the sail being bent to hanks, while below the second reef it is laced to the stay with a small rope. There are two reefs in this sail. The lower sheet block moves from side to side on an iron traveler as the vessel changes her tack. The standing part of the jib-sheet fall hooks into a cringle on the first reef, instead of into the lower part of the upper jib-sheet block, as is generally the case on American vessels. The mainsail has four reefs, three of which are straight across the sail in the ordinary manner, while the "balance reef," or storm reef, runs diagonally from just above the 3-reef cringle, on the leech, to the

upper hoop near the throat of the sail. The head is bent to a gaff, the upper part of the luff to hoops, while the lower part, from the third reef down, is laced to the mast with rope. There is no boom to the foot, and the sheet is the same as on the jib, and, like the latter, runs from side to side on an iron traveler. The main gaff-topsail is nearly square; it has a long yard, but much less peak than the English-cut sails. The mizzen has two reefs; it is laced to the mast; is hoisted by a single throat-halyard that reeves through a sheave hole just below the hounds of the mast, and the end of which splices into a combination hoop and hook (of iron), the former running on the mast and the latter hooking into a shackle at the throat of the sail. The sheet trims to a wooden outrigger, extending outward from the starboard side of the stern. The mizzen gaff-topsail differs from the main gaff-topsail only in size, it being smaller.

The rig of the bankskuta resembles somewhat that of the ketch-rigged English fishing vessels, though as previously stated its rig is more properly that of a yawl. The masts are considerably taller, in proportion to the length of the vessel, than those of the British trawler; the mainsail is not so wide, has more hoist and less peak than the English cut sails. On the whole the Swedish vessel has not a large spread of canvas, especially if it is compared with American fishing schooners, and, judging from its form, there is probably little danger of its capsizing, since in fair ballast it is reasonable to suppose that sails or spars would first be blown away. It must, however, be slow, if not clumsy, in anything like moderate winds.

The proportion of length over all to width is about 2¼ beams. A vessel of 60 feet over all would be about 26 feet wide and 9 to 10 feet deep in the hold. The following are the dimensions of a vessel of this type: Length, over all, 63 feet; on keel, 42 feet; beam, extreme (at top of rail), 26 feet 8 inches; depth amidships (bottom of keel to top of rail), 13 feet 3½ inches; depth of hold, 9 feet; depth of keel, 18 inches; height of dead wood above keel, 2 feet 5¼ inches; height of bulwarks amidships, 16 inches; at stem and stern, 3 feet 9 inches; bowsprit, outside stem, 21 feet 9 inches; mainmast, deck to hounds, 46 feet 6 inches, hounds to truck, 24 feet 4½ inches; main gaff, 24 feet 4½ inches; mizzenmast, deck to hounds, 43 feet 6 inches, hounds to truck, 12 feet 9 inches; sprit, 33 feet; outrigger (beyond stern), 15 feet 9 inches. Sails: Jib, luff, 47 feet 3 inches; leech, 31 feet 1 inch, foot, 22 feet 6 inches; fore staysail, luff, 37 feet 6 inches, leech, 34 feet 6 inches, foot, 18 feet 2½ inches; mainsail, luff, 32 feet 3 inches, leech, 46 feet 6 inches, head, 22 feet 2½ inches, foot, 23 feet 3 inches; main gaff-topsail, luff, 24 feet 9 inches, leech, 18 feet, head, 18 feet 4½ inches, foot, 23 feet 7½ inches; mizzen, luff, 28 feet 6 inches, leech, 29 feet 7½ inches, head, 18 feet, foot, 19 feet 1½ inches; mizzen topsail,

luff, 18 feet, leech, 19 feet 6 inches, head, 16 feet 6 inches, foot, 17 feet 7½ inches.

The foregoing descriptive notes are based upon vessels built at and prior to 1883. Models of the bankskuta exhibited at Bergen, however, indicate that in recent years a material change has been made in their design. The recently built vessels of this type (fig. 52) have a raking stem and sternpost. The bow and stern are sharper and much better formed than those of the earlier vessels, while the floor is sharper and not hollow; thus the modern fishing vessel employed in the bank fisheries is much improved in bouyancy, speed, and seaworthiness, if the

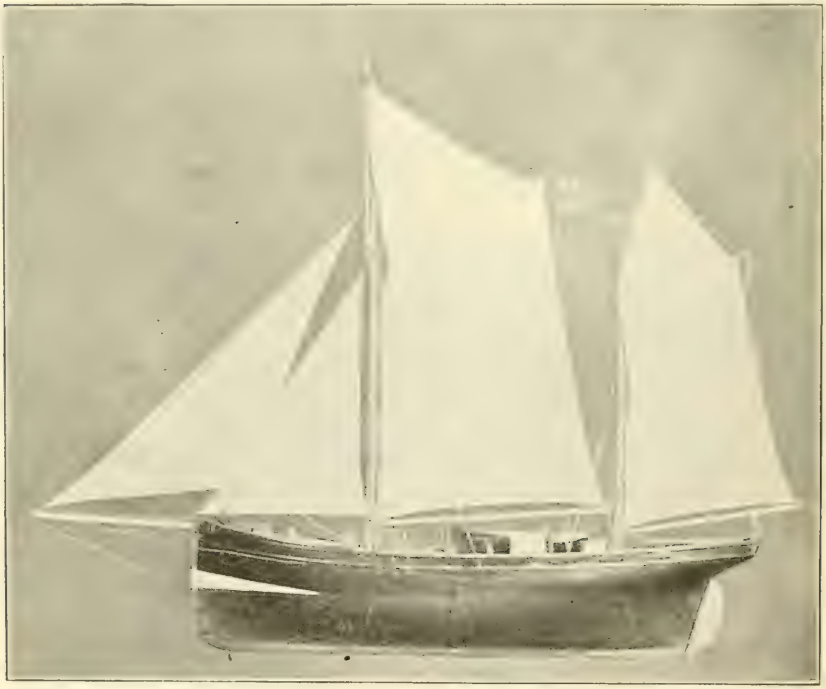


FIG. 53.—Swedish fishing ketch.

latest models fairly show the changes made. The rig remains the same. The relative dimensions of a modern bankskuta, represented by a model exhibited at Bergen, are as follows: Length over all, 51 feet 4 inches; beam, 18 feet 4 inches; depth, 7 feet; mainmast above deck, 48 feet 8 inches; main gaff, 23 feet 4 inches; mizzenmast above deck, 37 feet 6 inches; bowsprit, outside stem, 17 feet 10 inches.

Fishing ketch. In recent years the English type of ketch-rigged fishing cutter has been introduced for bank fishing outside the Skaw. These are, of course, sharper and generally better formed than the old-fashioned bank sloop, and are much swifter than the latter—a quality which is especially advantageous to the fisheries.

A model of one of these vessels (fig. 53) was exhibited in the collections of the Stockholm Fisheries Museum.

This type of vessel is carvel built, with sharp bow; straight nearly vertical stem, except at forefoot, where it is curved; rather shallow keel; sharp floor; long easy run; moderately raking straight sternpost; round-heeled rudder; overhanging round stern; moderate sheer; flush deck; steers with tiller; binnacle just forward of mizzenmast; cabin companionway 5 or 6 feet farther forward; boat usually stowed on deck.

It has a short running bowsprit; a moderately long mainmast, about one-quarter the vessel's length from the stem; a short main topmast, and pole mizzenmast, which is almost as far from the taffrail as the mainmast is from the stem. The jib sets flying; the stay foresail sets on stay to stem head; the boom and gaff-mainsail is low on the peak compared with British sails; the jib-headed main gaff-topsail is laced to the topmast; the boom and gaff spanker or "mizzen" also has a low peak, and over it is set a club-headed topsail.

Following are the principal dimensions of an average size vessel of this kind: Length over all, 64 feet; beam, 17 feet; depth, 7 feet; mainmast above deck, 42 feet; main topmast, heel to truck, 23 feet; main boom, 26 feet; gaff, 25 feet; pole mizzenmast, deck to truck, 38 feet; spanker boom, 20 feet; gaff, 18 feet; topsail yard, 18 feet; bowsprit, outboard, 19 feet.

Mackerel fishing boat.—The mackerel fishing boat of Bohuslän (fig. 54) has some of the features of construction and rig which characterize the bankskuta of this province. A large fleet of these decked boats is employed during the season in the drift-net mackerel fishery; hence they are called "mackerel boats," though at other times they may engage in various branches of fishery.

According to Von Yhlen, there were, in 1878, in all Bohuslän, 370 mackerel boats, with an aggregate tonnage of 3,480 tons, carrying 10,450 nets and 3,480 men. Some boats of 5 to 8 tons, each carrying 4, 5, or 6 men and boys, engage exclusively in the hand-line mackerel fishery, says the same authority, from the middle of June to the last of July.

"Any afternoon during the season," he writes, "from 150 to 200 boats, each 8 to 10 tons and carrying 4 men, may be seen in the narrow channels between the islands engaged in the mackerel net fishery."

Since 1878 there has been an increase in the fleet, which in recent years has numbered from 420 to 563 boats. As has been stated, 520 of them were engaged in the mackerel fishery in 1896. Dr. Lundberg makes the following reference to their work:

It is only in Bohus that the mackerel fishery is of any importance or where it forms a separate industry. It is true that mackerel are found in the Cattegat and in the Sound, but they do not occur in large numbers and are caught only together

with other fish. The fishermen of Bohus fish for mackerel with "dörj" and with drift nets in the Gulf of Bohus, the Skagerack, and the Cattegat, and, though nowadays more seldom, with seines inshore.

The drift-net fishery is carried on from May until the middle of July. During the latter part of the summer the fishing is carried on by means of mackerel lines for "reeling" or "railing"—towing plummets under sail, with a bit of mackerel skin as bait. As we have mentioned before, the bank-fishery boats take part in the mackerel fishery in the North Sea, but the greater number of fishermen use smaller decked boats with crews numbering 4 or 5 men. The fish is disposed of at home in Grafvarna, Smögen, etc., and at Gothenburg. Those who fish in the Skagerack and the North Sea sell their catch in Norway, from whence it is sent to America. It is dis-

FIG. 54.—Mackerel boat.

posed of fresh on ice within the country, or exported to Norway, England, Denmark, or Germany. Even the mackerel thus exported usually finds its way to America. A small quantity is salted at home for native consumption.

The mackerel boat is usually built of fir; is generally from 24 to 28 feet long on the keel and from 5 to 8 tons measurement, though occasionally as large as 10 tons. It is wide and deep and, in good ballast, has almost a maximum of stability, a quality which is essentially necessary in the region where they are used, since, according to Dr. Mahlm, the wind blows from the highlands of the coast in sudden and furious gusts, which would be extremely dangerous to vessels of ordinary width and form.

It is a decked, sharp-ended, clinker built keel boat, with hollow under-water lines, and rather strongly convex above; sharp floor; easy round bilge; raking curved stem and sternpost, and moderate sheer. The deck is flush with the gunwale, but there is an open railing about a foot high running along the sides. The low cuddy companionway is forward of the mainmast, and between the masts are hatches for the stowage of nets and fish. Abaft the mizzenmast is a small circular or oval-shaped cockpit for the helmsman. A small boat, usually a short wide praam, is carried on deck.

The mackerel boat is yawl rigged, with running bowsprit going through iron band at stem head; pole mainmast about one-third the boat's length from stem, and pole mizzenmast 5 or 6 feet from the sternpost. Ordinarily it carries a jib set flying; a stay foresail set on stay to

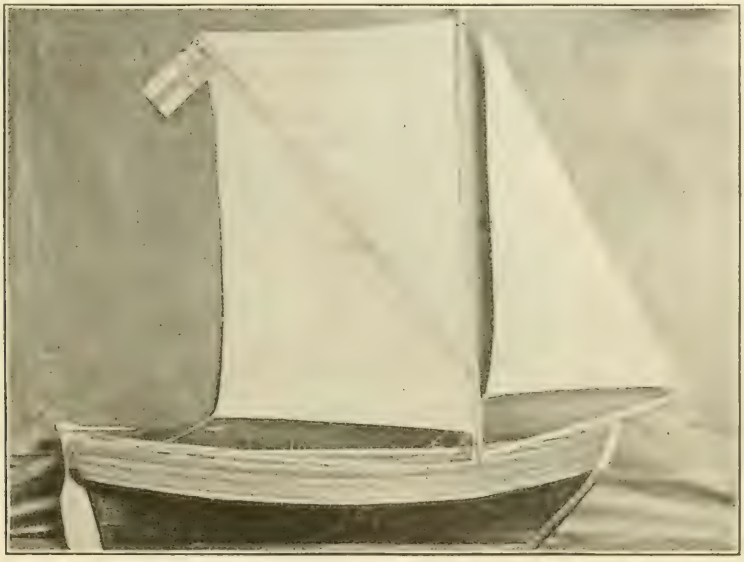


FIG. 55.—Banker's trawl-line boat.

stem head; loose-footed gaff-mainsail (sometimes a sprit-mainsail); club-headed or jib-headed main topsail; loose-footed sprit jigger sail that trims to outrigger, and sometimes a topsail set over the jigger, though generally the mizzenmast is not long enough for this. On the model exhibited at Bergen the mainsail was bent to hoops, and the sprit jigger was laced to the mast; but it has not been uncommon for both sails to be laced.

Following are the relative dimensions of one of these boats: Length over all, 42 feet 3 inches; beam, 15 feet; depth of hold, 6 feet 3 inches; mainmast above deck, 42 feet; bowsprit outside stem, 15 feet 3 inches; main gaff, 20 feet 2 inches.

Bank-trawlers' boat.—A special type of boat called "kvassing" or "kak" (fig. 55) is used on the coast of Bohuslän for setting trawl-lines

from the bankers that fish outside the Skaw. It is also employed in the coast fishery for haddock, bait species, etc.

It is an open, clinker-built keel boat, with raking stem, sharp bow, rising floor, well-shaped run, and V-shaped square stern. It has a square-footed rudder, moderate sheer, but rather quick rise at the bow, and is provided with a stern seat and three thwarts. It is sloop rigged, and carries a wide-headed sprit-mainsail and a jib set on an adjustable bowsprit.

Boats of this type are seaworthy and good sailers, but they are much less convenient than dories for stowing on a vessel's deck, and are therefore less suitable for bank fishery.

The relative dimensions are as follows: Length over all, 21 feet 7 inches; beam, 8 feet 4 inches; depth, 3 feet 6 inches; mast above gunwale, 18 feet 6 inches; bowsprit outside stem, 3 feet 4 inches; width of mainsail, 10 feet; oars, 12 feet 2 inches.

Bohuslän herring boat.—A type of sharp stern, open, clinker-built, keel fishing boat is used on the coast of Bohuslän for operating herring gill nets set near the shore, and locally called "standings nets." This boat has raking stem and sternpost; sharp floor; hollow water lines; strong shear, and large beam. It has six thwarts; is yawl rigged; and in light winds carries a main gaff-topsail set on a pole by a halyard rove through a hole at the top of the mainmast. It has a loose-footed gaff-mainsail and sprit jigger.

Its relative proportions are as follows: Length over all, 26 feet 6 inches; extreme width, 10 feet 6 inches; depth, 3 feet 3 inches; mainmast above gunwale, 21 feet 3 inches; mizzenmast above gunwale, 17 feet 3 inches; bowsprit, outboard, 3 feet 7½ inches; gaff-topsail pole, 19 feet; oars, 16 feet 6 inches.

Bohuslän fishing yawl.—An open, clinker-built, sharp-ended, keel boat is used in the coast fisheries of the archipelago of Bohuslän. It has a sharp floor; hollow water lines; raking stem and sternpost; strong sheer and a square-heeled rudder. It has a yawl rig.

It carries a jib and loose-footed sprit-mainsail and jigger, the sheet of the latter trimming to a short outrigger.

It so closely resembles the herring boat of Bohuslän that the two may be considered one type, the only apparent difference being in details of rig.

The following are the relative dimensions of a boat of this type: Length over all, 29 feet 7 inches; beam, 8 feet 9 inches; depth, 2 feet 6 inches; mainmast above gunwale, 26 feet 8 inches; mizzenmast above gunwale, 17 feet 2 inches; bowsprit outboard, 2 feet 6 inches.

Skåne fishing boat.—There are several types of fishing boats from Skåne, which engage in the so-called "Sound fisheries," whence is derived the name "Sound fishing boats," which is often applied to them. Some of the largest of these are decked, but others are open. In all cases, however, the larger ones are sturdy, seaworthy boats.

The general appearance of the fishing boats of Skåne is shown in figure 56. As will be noticed, they are double-ended; clinker-built; decked boats; with broad beam; single mast; and cutter rig. They have a high freeboard, and are well designed to carry a large cargo of fish and to sail dry in choppy seas such as they are liable to encounter.

Many of these boats strongly resemble those used by the Danes who frequent the same fishing grounds. Nor is this surprising, in view of the fact that it is common for the fishermen of one country to purchase boats from the builders in the other.

FIG. 56.—Skåne fishing boats.

Dr. Lundberg is authority for saying:

Skåne has no boat peculiar to that province. The Sound boat is principally used in the fishing on the Cattegat and the Sound; the Bornholm boat, which gradually began to come into use on the east coast of Skåne, and seems destined to take the place of the third form; the Blekinge boat, which, however, is still in general use on the south and east coast of Skåne.

At present the Sound boats are generally covered, with the exception of the Torekov and Mölle boats, which, even when of considerable size, are open, because they are also used for carrying lumber, etc. The smaller boats, however, are all open, as is the case with all the fishing boats used on the coast of Skåne. Most of the Sound boats are at present built at Viken, north of Helsingborg. Their general dimensions are as follows: Length from stem to stern, 30 feet; length of keel, 19.5 feet; breadth back of the mast, 12 or 13 feet; depth of hold, 4.5 feet; height of the mast, 32 feet. Generally they have only one mast, with a boom and jib. They also have a topsail, fastened to a pole attached to the top of the mast.

A common Bornholm boat, such as is used on the east coast of Skåne, measures 26 feet from stem to stern by 13 feet in breadth back of the mast, and has a hold 4 feet deep. Their sails are, as a general rule, like those of the Blekinge boats. These boats are built in Bornholm.

The Blekinge boats vary in size, the largest being of the same size as the Bornholm boats, having only one mast and one square sail, which can be hoisted and let down very rapidly. They are good sailers, but there is always some danger of their being upset.[1]

At the time the above was written Dr. Lundberg was of the opinion that the open boats on the east coast of Skåne would probably be

FIG. 57.—Skåne fishing boat.

replaced by decked boats, which he considered absolutely necessary for the safe prosecution of the winter salmon fisheries.

A large, open, double-ended, clinker-built, keel boat (fig. 57) is still used, however, in the fisheries from Skåne, on the south coast of Sweden. This boat is deep and wide, with a sharp floor, flaring sides, straight, moderately raking stem and sternpost, deep keel, square-footed rudder, three thwarts, and a stern seat. It is cutter-rigged, with loose-footed sprit-mainsail; fore staysail tacking down to stem

[1] Fisheries of Sweden, Stockholm, 1883, by Rudolph Lundberg.

head; jib set flying on an adjustable running bowsprit, and pole topsail, the pole coming down two-thirds the length of the mast.

The relative proportions are as follows: Length over all, 27 feet 9 inches; beam, 10 feet 11 inches; depth, 4 feet; mast above gunwale, 30 feet; bowsprit, outside stem, 6 feet; topsail pole, 21 feet 8 inches; oars, 15 feet.

The most recently built fishing boats from Råå are of a type very common in southern Sweden. They are wide, double-ended, keel craft, with convex lines above and hollow or wave-shaped lines at and below water line; also hollow floor. They have a graceful but moderate sheer, with rudder hung outside. The largest are yawl-rigged, carrying jib, fore staysail, mainsail, gaff-topsail on the pole mainmast and a small jigger sail on the mizenmast.

These boats are decked and are provided with trunk cabins for sleeping, cooking, etc. They are considered stanch craft, with much initial stability, and sail fairly well in fresh breezes and smooth water, though of course they would scarcely be considered swift when compared with finer-lined vessels.

A cutter-rigged, welled boat, with the same form of hull, is used in the fishery for flatfish. Its typical name is "kvasse." It carries a jib set flying on a running bowsprit, stay foresail, boom-and-gaff mainsail, and usually in light winds a jib-headed gaff-topsail.

Dr. Lundberg makes the following reference to this type in connection with the flatfish fishing in the Cattegat:

The Cattegat, especially in its western, shallower part, together with the shallower waters of the coast archipelagos, is the most suitable place in our salt waters for the species of flatfish, and a paying flatfish fishery is there carried on by the fishermen of Bohus and Skåne, and still more by those of Denmark. The fish most sought for is the plaice, which is caught there all the year round.

The Swedish flatfish fishery in the Cattegat has developed of late, owing chiefly to the efforts of the fishermen from Skåne, who equip boats specially to this end, the so-called "kvassar," of from 5 to 10 tons burden, not including the well room with which they are provided (called the damm, "cauf") and in which the fish can be conveyed alive to the place of sale, the towns on the Sound, especially Copenhagen. These boats cost from 3,500 to 4,500 kronor (£195–£250). The crews consist of 5 or 6 men, who are partners in the boat and who each provide about 8 nets of some 100 fathoms in length. But the Swedish fishermen now begin to imitate those of Denmark in using the so-called "Snurrevaad," a sort of apparatus that is not without its ill effects on the fishery and which fishing gear has been forbidden within Swedish jurisdiction upon the Bohus coast. The fishing grounds are chiefly north of Anholt and up toward Læssö, etc. The boats return home with their catch. This fishery was begun by Råå fisherman in 1879 with but 1 "kvasse;" in 1880 the number had already reached 9, and in 1881 there were 23 such boats at Råå. At present the number of vessels from that and some other fishing places amounts to 33, of which a few fish occasionally in the southern Baltic. The value of the Skåne "kvassar's" flatfish fishery in the Cattegat amounted in 1895 and 1896 to 58,714 and 80,620 kronor, respectively. The greater part of the catch consisted of plaice, of which the values in the years named were 50,508 and 71,551 kronor.

Cimbrishamns fishing boats.—A large fleet of fishing boats is employed from the harbor of Cimbrishamns, in the extreme south of Sweden, particularly during certain fishing seasons. At such times it is common for the boats to assemble in the harbor in large numbers, especially when they come to market their catch. Such a fleet is shown lying at the pier in Cimbrishamns Harbor in figure 58, which not only gives a good idea of the types of boats used there, but also indicates the local importance of the fishery. As will be seen, the boats are nearly all of the sharp-stern, single-masted, cutter-rigged type, so common to most localities in southern Sweden. Square-stern boats are the exception. The clinker build is practically universal in this instance, and the boats are mostly decked.

FIG. 58.—Cimbrishamns fishing boats.

The boats employed from Cimbrishamns are more clearly shown in Plate XXVII. This form somewhat closely resembles the Norwegian pilot boat, though still differing sufficiently to constitute a type. It is a sharp-ended craft, with strongly convex lines at the deck and concave and much easier lines at the water. Both the stem and stern post are vertical or tumble in slightly at the top, but curve gracefully below. The boats are clinker-built keel craft; usually with hollow floors and deep keels. They are decked, with only a very low rail. Aft is the little cabin, with a low deck house to give additional headroom.

The cutter rig is in favor. This consists of a loose-footed sprit-mainsail, with low peak and narrow foot; foresail (or fore staysail), and jib-headed pole topsail set over the mainsail in light winds. These

CIMBRISHAMNS DECKED BOATS.

boats are generally about 22 feet to 25 feet long over all, and 7 to 8 feet wide.

Blekinge fishing boats. Two models of the boats peculiar to Blekinge were exhibited at Bergen. One of these represented a boat of the larger class and was yawl rigged, while the smaller one had a loose-footed wide-headed sprit-mainsail, and jib tacking down to stem head. As a matter of fact, these small boats are often propelled by oars, at which times the sails are furled and the mast taken down.

The boats used in this region are peculiar to Sweden and are known by the special name of Blekinge boats. The original type—the so-called "brakeka" (fig. 59)—have

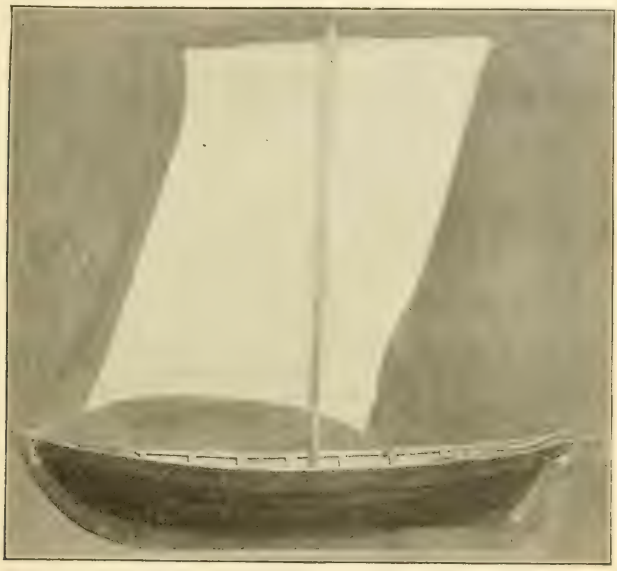


FIG. 59.—Blekinge brakeka. (Photographed by T. W. Smillie.)

a single mast and one sail, "raasagel."[1] At present this rig is being abandoned and sprit-sails used, often with two masts. When there are two masts the after one is the smallest.

The Blekinge boats are seaworthy, and can carry sail in a high sea. Their size varies and can be roughly estimated by the number of planks on each side. Thus, to ascertain the length of a boat, multiply the number of strakes on a side by 3 to 3¼. A boat having six planks would be from 18 to 21 feet long.

In the vicinity of Stockholm the fishing boats use the "raasagel," or frequently sprit-sails with one or two masts. They are usually built of pine; but farther south, at Ostegotland and Kalmar Län, the boats are made of oak, the construction being similar to that of the Blekinge craft.[2]

The rig of the old-fashioned "brakeka" or "vrakeka," as it is variously called, has certain features that mark it as distinctively Scandinavian. The mast is stepped in the middle of the boat, and receives

[1] A sail bent to a yard.

[2] Fisheries of the Baltic, by Rudolph Lundberg.

no support from passing through a thwart, as is generally the case in nearly all small boats. It is supported by a forestay that sets up at the stem head (in this case reeving through a block), and by a single shroud on each side. The shrouds have curious curved yokes, or toggles, on their lower ends, which are inserted into rope beckets that are fastened to the timbers some distance aft of the mast. There are several of these loops or beckets attached to each other like links of chain, and the "set" or rake of the mast may be changed at will, it would appear, simply by shifting the toggles from one loop to another and slacking away or hauling taut on the forestay. It will be remembered that this method of "setting up" the rigging is the same as that in use on the boats of Söndmöre, Norway.

The square sail (raasagel) is a sort of connecting link between the lug and the square sail, though perhaps it may properly be classed with the former. It has six rows of reef points, is bent to a long yard at the head, and when sailing closehauled the larger part of the sail, more especially at the foot, is forward of the mast, the clew coming only a short distance aft of amidships.

The oars, where they come in the rowlocks, are cased on three sides with thin strips of hard wood, this part of the looms being square.

Following are the dimensions of one of the old-style boats: Length over all, 25 feet 4 inches; keel, 17 feet 4 inches; beam, 8 feet 4 inches; depth, 2 feet 10 inches; depth of keel, 11 inches; width of stern, 2 feet 10 inches; mast, 21 feet 8 inches; yard, 17 feet; oars, 10 feet 8 inches; sail, luff or forward leech, 16 feet 8 inches; after leech, 18 feet; head, 16 feet; foot, 14 feet.

The largest of the modern-rigged boats is known by the generic name of "blekingseka." This is a yawl-rigged boat with running bowsprit, and carries jib, fore staysail, sprit-mainsail, sprit-mizzen, and one or two jib-headed topsails set above the main and mizzen sails in light weather. The luff of these topsails is, in either case, fastened to the upper end of a long pole that is hoisted to the masthead by a halyard, and the lower end of each pole, which is only 4 to 6 feet above the thwart, is lashed to the mast. The topsails sheet home to the peaks of the lower sails.

The smaller, skiff-like rowboat of Blekinge is similar to a common form of fishing skiff used in western Nova Scotia, and it seems more than probable that this kind of craft was introduced into that province by Scandinavian fishermen who have settled there.

Both the large and small boats are used in the long-line and net fisheries of the south coast of Sweden, from Blekinge to Helsingborg, and even to Anhalt.

The smaller of the Blekinge boats (fig. 60) is usually about 18 feet long over all and 5 to 6 feet wide. Those rigged as yawls are much larger, the average size being about 26 feet long. The cost varies with the size from $54 to $135.

The large boat has a crew of 4 or 5 men, or 3 men and a boy. Its equipment for the herring fishery consists of 80 gill nets made of cotton, each 126 feet long, 21 to 24 feet deep, and from 12 to 13 meshes to the foot. These nets are used chiefly for drifting.

Capt. C. Smith, of the royal navy of Sweden, writes as follows concerning the blekingseka:

The boat owes its name to the province of Blekinge, where it is chiefly built, and the Swedish word "eka," a boat constructed of oak. According to the different tasks they are used for, these boats are, of course, differently fitted and rigged, most of them having a sprit-mainsail and a fore staysail, but the lugsail rig is principally used for the herring boat or the "vrakeka," as it is called in Swedish, the name being derived from the word "vraka," to drift with the nets.

As the "vrakeka" is never decked, although it is seen far out at sea in all weathers, it must be an excellent sea boat as far as regards her quality to live in rough water.

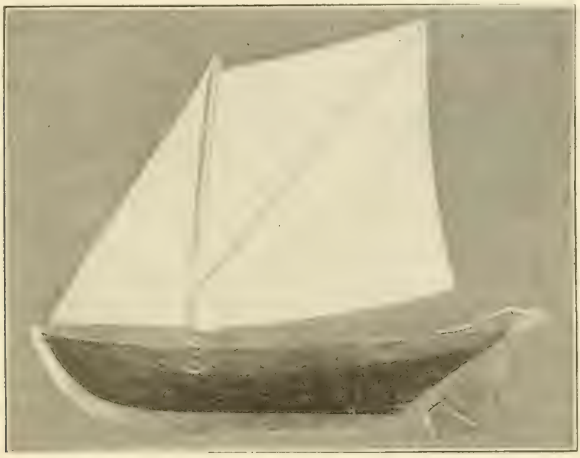


FIG. 60.—Blekinge fishing boat.

The whole shape of the boat also shows a general tendency to go over the water rather than through it, and the hull is built as light and elastic as possible. Generally it sails without any ballast at all, with a crew of 5 or 6 men.

The position of the sail adds to the buoyancy of the boat by the mast being, with a strong backstay as well as with the halyard, heeled over to windward, the sail thus forming an inclined plane, on the under side of which the wind acts, tending to lift the whole boat. It makes a very curious appearance to see these boats sailing by the wind in a fresh breeze, with their lee gunwales almost in the water and the masts yet standing quite perpendicular.

Another very peculiar idea in the management of these boats is that when scudding in a gale of wind the whole crew, except the helmsman, and all the cargo, are stowed before the mast, thus bringing down the head, quite contrary to the custom on all other boats in similar circumstances. The fishermen say the boats scud better in this trim, the bow making less resistance, and the raised stern keeping off the seas better. In this condition the boat, of course, shows a great tendency to broach to, but the enormously big rudder is generally sufficient to counteract this, or if not, an oar is kept in readiness on each side. It happens sometimes that the boats gets damaged when riding to the nets, but no instance is known of their ever being injured when scudding.

The boat is generally built wholly of oak. Keel, stem, and sternpost about 2 inches in thickness, with no rabbet cut into them. Planking 1 to 1¼ inches thick, built, so to say, in the free air, without any frames whatever or without any other guidance than the builder's eye or "rule of the thumb." Nails, of iron, clouted, or very rarely clenched. Timbers of oak, 3 inches by 2 inches, 3 feet apart, fastened by juniper-tree nails. The two forward timbers reach only halfway up, rendering the bow more elastic. Inwale, 3 inches by 4 inches, thinned off toward the ends.

The mast stands nearly in the middle of the boat, a step being nailed on the keel, but no thwart or any other arrangement for steadying it, except a stay to the stem head and two backstays. A wooden parrel is used on the lugsail yard, which is dipped in tacking, while the mast, by means of the backstay, is heeled over to the weather side. The halyard also assists in steadying the yard, being always belayed to windward with a slippery hitch. A long boat hook, put into one of the earings on the luff, is used as a bowline.

The water lines and buttock lines are as fine as may reasonably be expected in a boat built without any drawing or any calculations whatever. Nevertheless, the center of buoyancy corresponds very nearly on the same vertical with the center of lateral resistance without the helm, making the boat thus very handy and well balanced. Even the line of displacement shows a resemblance to the wave form.

The boat is also a very fast sailer, tolerably close winded, and especially an excellent sea boat, but being so light and buoyant, she has not very much power to force herself against a lumpy sea. In scudding before a gale of wind she is probably not surpassed by any craft of her size.

Södermanland fishing boat.—The fishing boat chiefly used on the coast of the province of Södermanland is a clinker-built, square-stern craft, something like the "blekingseka;" but with a much stronger sheer and greater rake to its bow. It has a loose-footed sprit-mainsail and jib tacking down to the stemhead.

The Gotland fishing boat.—Gotland is the largest island off the coast of Sweden, and the "strömming" fishery is of great importance to its population. This fishery for small herring is prosecuted with set gill nets and drift nets at all seasons of the year, but chiefly from April to December. A large fleet of boats is employed. As long ago as 1869, 606 boats, manned by 1,911 persons, engaged in the fishery.

There are slight differences in the boats, but they are mostly of one kind, designed specially for being hauled out on the shore. They are from a little less than 23 to 26 feet long, and are rather light in construction, making them easier to handle when being hauled out or launched. It has been said that they are less strongly built than those on the coast of Blekinge and Schonen, but they are, nevertheless, very seaworthy and are often out in heavy storms.

The boats engaged in the drift-net herring fishery have 30 nets and 3 men, and are, therefore, designated as "tre manningar."

This boat has a fine sheer on top, is open, and clinker-built; with 7 strakes on a side; 15 frames and 5 thwarts, two of the latter being pierced with holes to receive the masts. It has a deep keel; curved stem and sternpost, both of which rake very much. The ends are shaped nearly alike, both being sharp, with slightly convex lines; while the bilge is rounding; and the sides flare somewhat above water.

It is schooner-rigged, and usually carries two small loose-footed sprit sails and jib tacking to stemhead. Occasionally supplementary light sails -topsails set on poles and another jib may be used in moderate winds, but the typical rig is as above described.

The oars are made on a remarkable pattern: The blade of each is flat on one side, and beveled on the other; the loom is square for nearly half its length, but the upper part, next the handle, is as wide or even broader than the blade, and quite thick and heavy. To this is fastened a cleat, having a hole in it which is large enough to ship over the single, round, wooden thole pins that are used. Stone killicks are used for anchoring the boat or nets.

Following are the relative dimensions: Length over all, 25 feet 2½ inches; beam, 6 feet 7 inches; depth, 2 feet 6½ inches; foremast above thwart, 9 feet 8 inches; mainmast, above thwart, 9 feet.

Dalarö fishing boat. —An open, clinker-built keel skiff, called "kol-

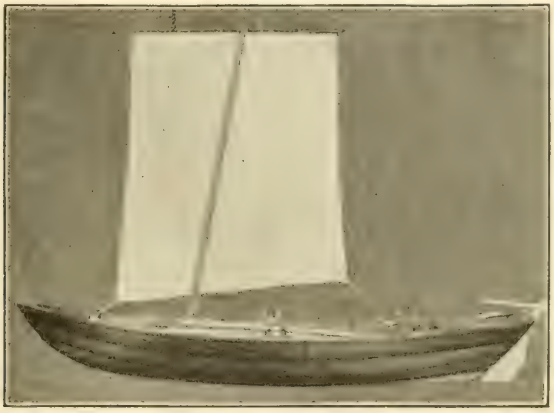


FIG. 61.—Dalarö fishing boat.

ekstock" (fig. 61), is used in the fisheries from Dalarö and its neighborhood in the coast archipelago of Stockholm.

It has a sharp bow; curved, strongly raking stem; round bilge, practically no run; and raking square stern; rudder hung outside. It carries a square sail set on mast standing about one-third the boat's length from the stemhead.

The following are the dimensions of a boat of this type: Length over all, 20 feet; beam, 6 feet 4 inches; depth, 23¾ inches; mast above gunwale, 12 feet 1 inch; yard, 9 feet 2 inches; oars, 11 feet 3 inches.

Vaxholm fishing boat.—A long, rather narrow, canoe-shaped, clinker-built keel boat, is used for "strömming" fishing in the Stockholm archipelago. It has long, easy lines fore-and aft, with round, rising bilge; flaring sides; moderately raking, curved stem; shallow keel; straight, raking sternpost; five thwarts (one at the extreme bow for the foremast to set in), and two sprit sails. It is fitted with the ordinary Scandinavian

rowlocks, and on each side with two fork-shaped wooden supports for the oars. Boats of this type row easily and are very swift under sail. They are used only by the fishermen at Vaxholm and vicinity, in the central part of the archipelago, who do not go outside the islands.

The relative dimensions of a boat of this type, as represented by a model exhibited at Bergen, are as follows: Length over all, 28 feet 6 inches; beam, 7 feet 3 inches; depth, 2 feet 6 inches; foremast above gunwale, 12 feet 11 inches; mainmast above gunwale, 14 feet 2 inches; center to center of masts, 10 feet; oars, 15 feet 10 inches.

Stora möja fishing boat.—The boats employed in the fisheries from the island of Stora möja in the Stockholm archipelago are so similar in form to the Belkinge boats that a detailed description seems unnecessary. The chief difference seems to be in the rig, which consists of a single square sail set on a raking mast stepped a little more than one-third the boat's length from the bow.

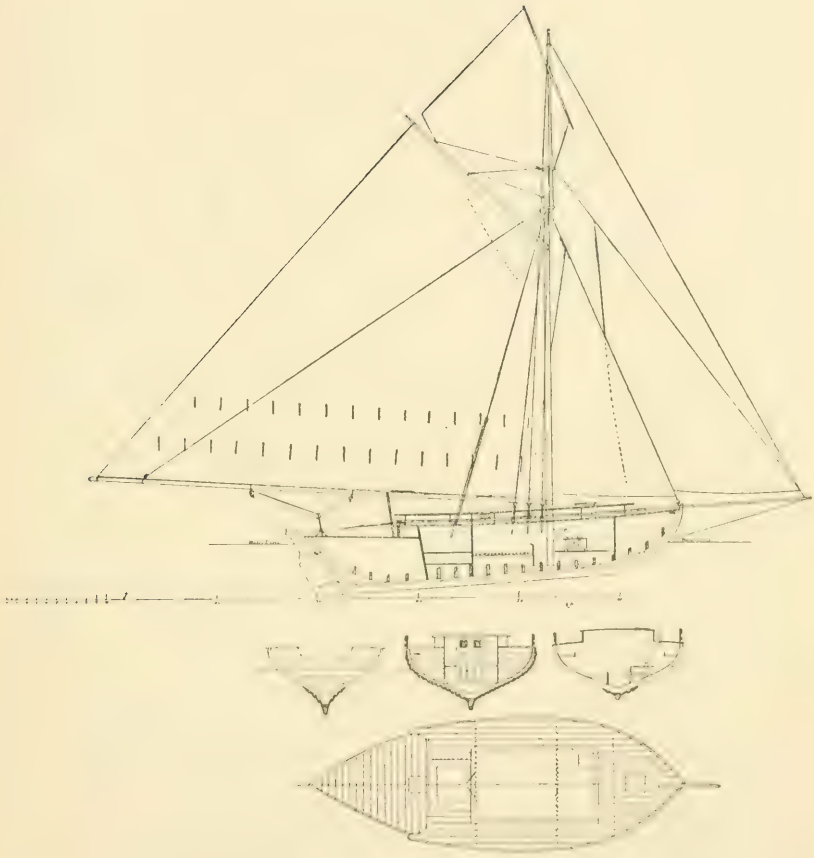
Öregrund fishing boat.—A sharp-ended, clinker-built, open-keel boat is used in the "strömming" fishery from Öregrund and neighboring islands in the Stockholm archipelago. It has a two-sail cat rig. The foremast stands close to the stem; on it is set a small loose-footed sprit-foresail. The mainmast is about three-fifths the boat's length from the stern, and the loose-footed sprit mainsail has about twice the area of the foresail.

This type of boat is broader and deeper than that from Vaxholm, and its lines are fuller. A boat from Öregrund, 24 feet long, would be about 7 feet wide and 2 feet 9 inches deep.

Stockholm welled fishing boats.—On the Swedish coast, near Stockholm, a peculiar type of welled boat (Pl. XXVIII) is used for the transportation of live fish, the special characteristic of this being that the well in which the fish are kept alive is located at the extreme after part of the vessel. There are two classes of these, the larger boat being a cutter-rigged craft, and the smaller a rowboat. A model of the larger welled boat was exhibited at Bergen.

It is a clinker-built, beamy, keel boat, with sharp bow; stem strongly curved; hollow floor; clean, sharp run; a sharp, low stern, and a slightly curved, moderately raking sternpost.

The boat is decked about two-thirds of its length in the forward part, and this deck is elevated considerably above the stern; on top of it is a house or "trunk" about 2 feet high, 9 feet long, and with an average width of between 6 and 7 feet. The cabin in which the crew sleep and eat occupies the middle of the boat beneath the trunk just mentioned. Forward of the cabin is the hold wherein is stowed the spare sails, ropes, fishing gear, etc.; this is entered by a small hatch located just forward of the trunk. Aft of the cabin is a deep cockpit, in which the crew of the boat sit when she is sailing. The well in which the live fish are kept is, as previously stated, at the extreme



PLANS OF STOCKHOLM WELLED BOATS.

After Admiral Paris.

stern, and is a little more than 9 feet long. The outside planks are perforated with holes to permit the water to freely circulate through the well. The advantage claimed for having a well located in the extreme after part of a small craft is that it gives more cabin room.

But it seems possible that a boat may not be quite so swift with a well so far aft, while a craft that is made so low at the stern and which at the same time has that portion filled with water would probably be unsuitable for work in rough water. It is certain that the motion in the extreme end of the boat would be very materially greater than it would in the center, and in the pitching and scending incident to sailing in a choppy sea the fish might at times be exposed to the danger of being left nearly dry, or to injury from contact with the planking of the boat. The well is covered with a deck that is flush with the gunwales, and in this is a hatchway which is provided with a sliding cover or door. The fish are put into the well and taken from it through this hatch.

The following explanation of its use is given by Dr. Lundberg, who, as will be seen, asserts that despite the unusual location of the well the boat is reputed to be both swift and safe:

From Finland, especially from the island group of Aland, there are imported, besides salt strömming, living fresh-water fish such as pike, etc., to Stockholm. For this transport there is used a kind of boat with a well room called "Alands sumpar," and the same kind of vessel is used on the Swedish coast to transport living fish from the coast archipelago to Stockholm from as far south as the government districts of Östergötland and north Kalmarlän. These vessels have the peculiarity that the well room does not lie midships, but aft, where a number of small holes are bored, and which is separated from the other part of the vessel by means of a water-tight compartment. The part of the after deck thus cut off is lower than the other part of the deck, and, when the fish are kept there, is weighted with large stones in order that it may lie deeper in the water. These boats sail very fast, and the construction we have just mentioned does not act unfavorably upon their sailing powers.[1]

The so-called "rowing well boats" are sometimes rigged as sloops, with a sprit-mainsail and jib, the latter tacking down to the stem head.

It is, however, propelled only by two oars, which have permanently attached to them iron rowlocks (or what might be called iron pins bent at a right angle), which ship into holes in the gunwales. The boat is clinker built, eight strakes on a side; is sharp forward and aft, with full midship section and generally convex lines. The stem rakes very much and curves gracefully to meet the keel; the sternpost is straight and has a moderate rake. There is no raised section forward, as in the larger craft, and the rowboat is open with the exception of the well, which is at the stern, and is covered like that of the cutter.

Instead of a midship thwart there is a compartment (with a door on top) across the boat, which answers the purpose of a thwart and a receptacle for gear, bait, etc., and sometimes there is an inclosed place or cuddy at the bow.

[1] Fisheries and Fishery Industries of Sweden, pp. 71–72.

The average dimensions of the larger class of these well boats are: Length, 33 feet; beam, 12½ feet; depth, forward 6 feet, aft 4 feet. The rowboats average: Length, 14 feet; beam, 5 feet; depth, 2 feet.

Harnäs fishing boat.—The fishing boat from Harnäs, in the province of Upland, is peculiar in the form of its ends. It is a double-ended, clinker built keel boat, with flaring bow and stern, and strongly raking stem and sternpost to near the top, where they curve abruptly upward. The lower section of each is slightly concave, which, with the great rake and sharp angle of the curve above, gives the boat an odd appearance. It is entirely open, and has little sheer. The rig consists of a wide, loose-footed sprit-mainsail and jib tacking to inside of stem.

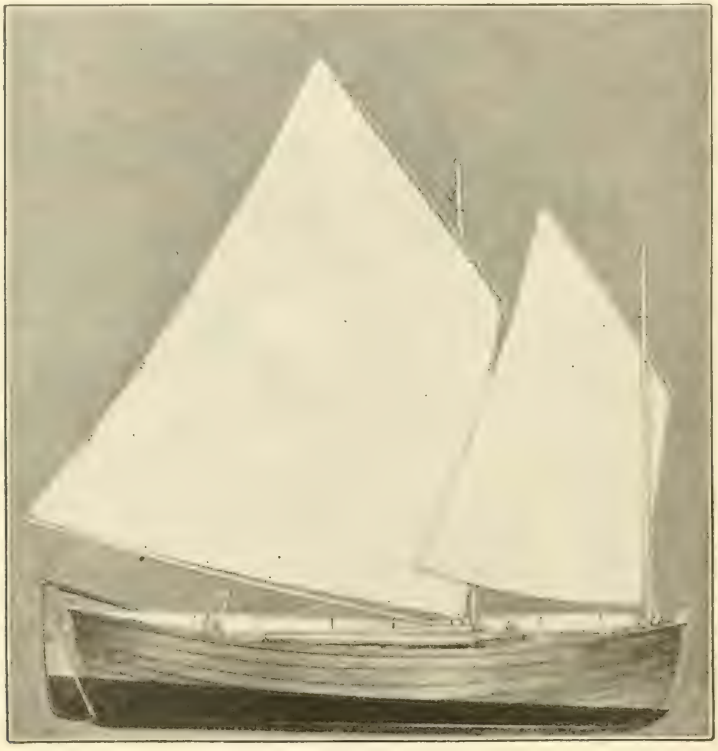


FIG. 62.—Helsingland fishing boat.

Helsingland fishing boat.—One of the best forms of open fishing boat used in Sweden, and having several improvements in design and equipment, has been built in recent years by Mr. J. Skoglund, of Hudiksvall, for the coast fishery of northern Sweden, in the Gulf of Bothnia (fig. 62). It has all the elements of a swift, buoyant, seaworthy boat. It is a sharp-ended, clinker-built, keel boat, with moderately raking stem, curved strongly at and below water line; slightly curved sternpost; stem, forward and after part of keel, sternpost, and heel of rudder are shod with metal. It has two thwarts for

oarsmen, an adjustable thwart, flush with the gunwale, to the after side of which the mainmast is held by a clasp; and one well aft for the steersman to sit on.

Its special feature consists of vertical canvas washboards that can be stretched along the sides. An eye in the after end of each is attached to a hook near the top of the sternpost, while a rope from the upper edge, passing through a hole in the stem, serves to pull it taut along the side and the metal supports, that are stuck into the gunwale when occasion demands their use.

The rig consists of two balance lugsails, the mainsail being much the larger. The foremast stands as far forward as possible; on this is set a small foresail, having two reefs. The mainmast is less than one-third the boat's length from the bow; on this is set a large boom lugsail, having three reefs, and with sheet trimming to a traveler on the

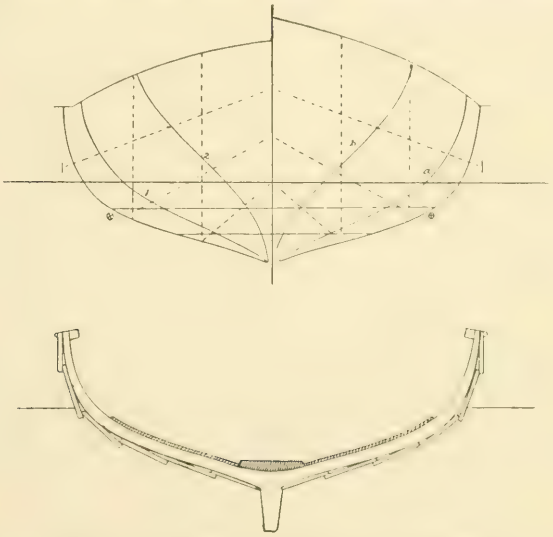


FIG. 63.—Body plan and cross-section of Piteå boat.

after side of the stern thwart. It is claimed that a boat of this type, when she is unencumbered with fishing gear, can be handled by one man, even in windward sailing, although the crew usually consists of 2 men, and sometimes 3. The fishing nets are generally placed aft, while the lines, etc., are stowed farther forward.

I am informed that many boats of this type have been built along the coast of Helsingland.

The relative dimensions are as follows: Length over all, 23 feet; beam, 8 feet 1 inch; depth, 2 feet 8 inches; foremast above gunwale, 14 feet 9 inches; fore yard, 9 feet 5 inches; stem to mainmast, 7 feet 4⅜ inches; mainmast above gunwale, 18 feet $3\frac{5}{8}$ inches; main yard, 13 feet 6½ inches; main boom, 16 feet 6 inches; oars, 10 feet.

Piteå herring boat.—The boats used in the herring or strömming fishery from the coast of Piteå, Gulf of Bothnia, are entirely open

and clinker-built (Pl. XXIX and figs. 63–64); the ends are shaped nearly alike, being sharp and well formed for speed; curved stem and sternpost; and moderate depth of keel. In a general way, they resemble the American whaleboat, though the latter is longer in proportion to beam and depth, and has finer lines.

The lines are concave, as is the case with so many of the Scandinavian fishing craft. The central part of the inside is sheathed up to the thwarts. There are two thwarts, or beams, for the masts, flush with the gunwale, that for the foremast being near the stem, and the other forward of amidships. Besides these, there are two thwarts for rowing; the rudder, as is usual in such boats, hangs outside. It is curved and round on the lower end, and is hung to a long pintle which extends considerably above the water, so as to make the hanging of the rudder easy, even when the boat is in a seaway.

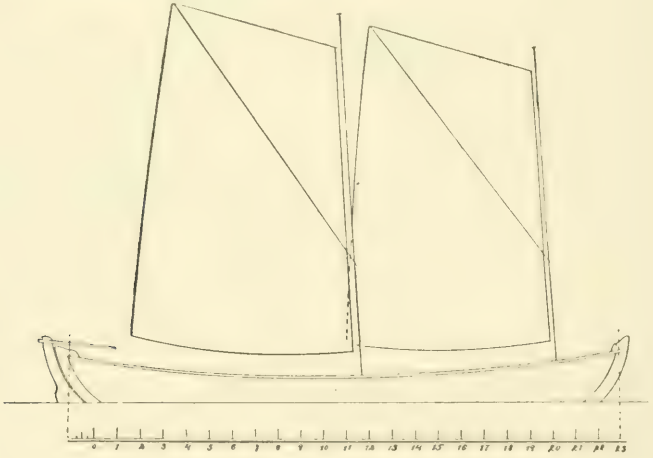
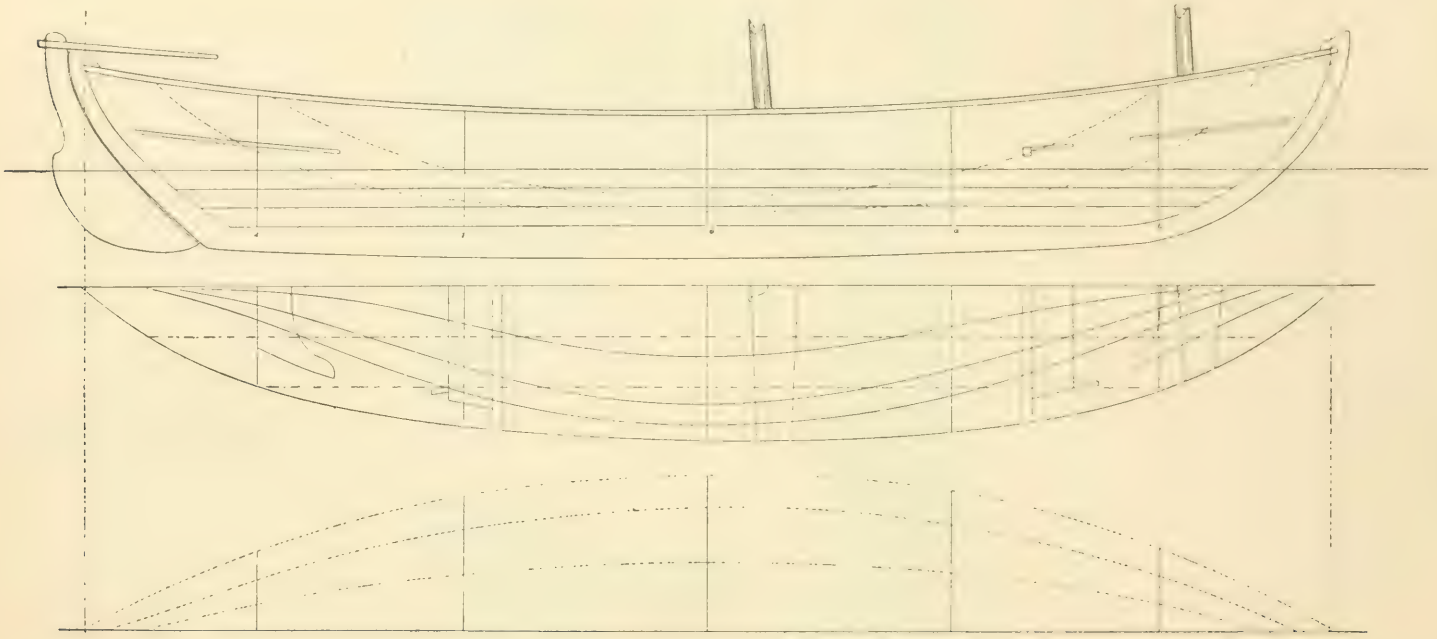


FIG. 64.—Sail plan of Piteå boat.

Boats of this class carry two rather small spritsails, which have no booms. The masts are held in place by metal hasps on the after side of the thwarts. The mainmast stands a little forward of amidships, and, contrary to the rule which usually prevails, the mainsail is larger than the foresail. A peculiar oar is commonly used, with the part next the handle almost as wide as the blade.

The Piteå fishing boat carries a crew of 2 men, and its equipment consists of 14 to 16 cotton herring nets, each 120 feet long and 10 to 12 feet deep. These nets are always set stationary, being anchored to the bottom. The boats of that region never drift for herring.

In going to or from the fishing grounds, according to Lundberg, large boats are used, which may be either decked or open, but the type above described is the one chiefly employed in actual fishing operations.



PLANS OF PITEÅ FISHING BOAT.

The following are details of measurements of one of these boats: Length over all, 17 feet; keel, 12 feet; beam, 5 feet 4½ inches; depth, top of gunwale to inside ceiling, 21 inches; height amidships, lower part of keel to gunwale, 2 feet 9 inches; to top of stem, 4 feet; sternpost, 3 feet 9 inches; depth of keel, 6 inches; spars, foremast, total length, 10 feet 10 inches; above thwart, 9 feet; mainmast, 11 feet 6 inches; above thwart, 9 feet 10 inches; foresprit, 8 feet 9 inches; mainsprit, 9 feet 6 inches; foresail, luff, 6 feet 9 inches, leech, 8 feet, head, 4 feet 9 inches, foot, 4 feet 9 inches; mainsail, luff, 7 feet 3 inches, leech, 7 feet 9 inches, head, 6 feet, foot, 6 feet 9 inches.

Manno fishing boat.—The boat used in the fisheries from the island

FIG. 65.—Sealing boat.

of Manno, in the government district of Norrbotten, at the head of the Gulf of Bothnia, is similar in form to the Blekinge boat, and, like it, is clinker-built.

It has a small loose-footed sprit-foresail, set on a mast stepped close to the stem, and a boom and sprit-mainsail, nearly double the size of the foresail, and the mainmast stands forward of amidships.

Sealing boat.—The requirements of the seal hunt in the Gulf of Bothnia, which is carried on during February and March, has resulted in the production of a most remarkable style of boat (fig. 65), which resembles in form the sternum of a sea bird. There are three species of seals in Sweden: The ringed seal (*Phoca fatida*), which is most numerous in the Gulf of Bothnia and northern Baltic; the harbor seal (*P. vitulina*), which is found as far north as halfway up the east coast,

and the gray seal (*Halichœrus grypus*), which occurs on all parts of the coast, but is most plentiful in the Baltic.

All the species are harmful to the fisheries, the gray seal especially so. They occasion much loss to the fishermen by eating the salmon and herring caught in the nets, besides the loss they occasion by the devouring of fish that otherwise might fall to the share of the fisherman.[1]

The fishermen go out to hunt them on the ice floes, at which time the large boats serve as lodgings, while smaller boats are dragged over the ice by the hunters when they go on expeditions.

Disguised in white clothes, and sometimes moving in a lying position, the men approach the seals which are gathered on the ice and shoot or spear as many of them as they can before the creatures can succeed in creeping down to the openings or "blowholes," which they themselves have made in the ice. These hunting expeditions, which last whole months, are now undertaken on a lesser scale than formerly on account of the decrease in price of seal oil and seal skins, and it is fancied that in consequence the number of these destructive animals has increased of late years. The State therefore pays a sum forming part of a bounty for the killing of seals, which are also caught with nets and traps of various kinds along the coast.[2]

The sealing boat, which plays so important a part in this industry, is an open, sharp-ended, clinker-built, keel craft. It has convex lines; overhanging ends; sharp floor; flaring sides; and straight, raking sternpost. The keel is deep at the after end and comparatively shallow at its forward end, or that part which, in any other boat, would be termed the stem. It slopes with a long, gentle, upward curve to the top of the bow. The bow is shaped something like the end of a deep spoon bowl, and is thus well adapted for running upon an ice floe. A sealing boat has high, upright washboards along its sides, and a single mast, standing near the middle of the boat, upon which is set a square sail.

The peculiar construction of this boat fits it for the purpose of breaking through ice, and a craft of this kind can, without difficulty, sail through ice 2 or 3 inches thick. The seal hunters go to sea toward the end of February and do not return until the sea is free from ice. When the boat is used as a house for the crew, it is pulled onto the ice and a wooden rest is placed under the forward end of the keel to keep the craft in a horizontal position. The sides of the boat are then supported by 4 notched poles, which serve as ladders to climb on board. Poles are fastened to the beam in the center of the boat, and on these is placed a beam, from which strong lines are suspended to rings on the outer canvas. A skeleton roof is thus formed, and when it is covered with the sail it affords an excellent shelter for the crew.

The sealing boat averages about 30 feet in length and 10 to 12 feet in width.

[1] Fisheries and Fishery Industries of Sweden, p. 62.

[2] Ib., p. 63.

Lake Venern fishing boat.—A finely formed, open, clinker-built, keel boat, locally called "snipa," is used in the fisheries of Lake Venern (fig. 66). It has a strong, symmetrical sheer; long, sharp bow and stern; rising floor; flaring sides; and strongly raking, curved stem and sternpost. Inside it has platform seats at bow and stern, the forward one extending well aft. It is also provided with two thwarts. It has four straight iron thole pins, to which the oars are attached by iron staples driven into the handles. This boat has a small sprit-sail; a jib tacking down to stem head; but the center of effort of the sails is so far forward that it evidently can not do so well in windward sailing as if the rig was better balanced. The boat is steered with an oar. Boats of this type are used mostly from Hammer, in Lake Venern. They are generally built of pine, but sometimes of asp. The planks are 1.5 cm. thick. It carries about 1,300 pounds,

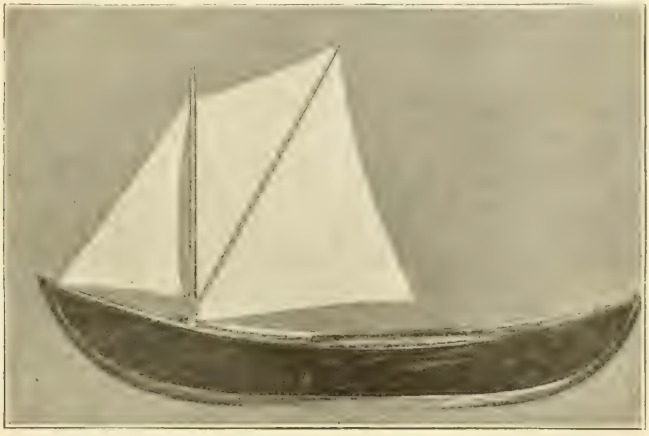


FIG. 66.—Lake Venern fishing boat.

with 2 men, and has a speed of 6 or 8 knots under sail. Boats of this size and form cost about $24 without sail, and with sails $27.

The following are the principal dimensions: Length, 22 feet; beam, 5.2 feet; depth, 1.9 feet; sail area, 140 square feet.

Lake Wettern fishing boat.—A special form of open, sharp-ended, clinker-built boat is used in the fisheries of the large lakes Wettern and Wenern. The boat found in Lake Wettern is called "Wettern snipa," and that of Lake Wenern is designated as "Wenern snipa." The former is about 16 feet 8 inches long; has fine lines; is reported to be swift under sail and easy to row, though rather crank. It usually has two masts and is steered with a rudder.

The Wenern snipa carries two sprit sails and jib, and is steered with an oar. It is rather larger than the other, being usually 21 feet 6 inches long. It costs complete $27.

Lake Siljan boat.—This is believed to be a very old type of Scandinavian boat, for its construction is similar to the old viking ships which have been exhumed. It is clinker built; has a light keel; curved stem, and straight sternpost, both of the latter raking very much. The ends are sharp and bilge high, the lines being convex. The peculiarity of its construction, however, consists in the way the planks, of which there are five streaks on a side, are put on and fastened. There are nine sets of timbers and a breasthook forward and aft. Over this frame the planks are fastened. They are apparently of the same width throughout, and their edges are chamfered off thin, so that when lapped over each other they project very little. The edges are fastened together with wire clinched on the outside. When the planks are on, the upper strakes are tapered off at each end to form the proper sheer on top, and around the outside is nailed a thin hard-wood ribband, which is all the gunwale there is.

This form of construction gives a very light boat that can be carried over portages, and which may be useful for many purposes where great

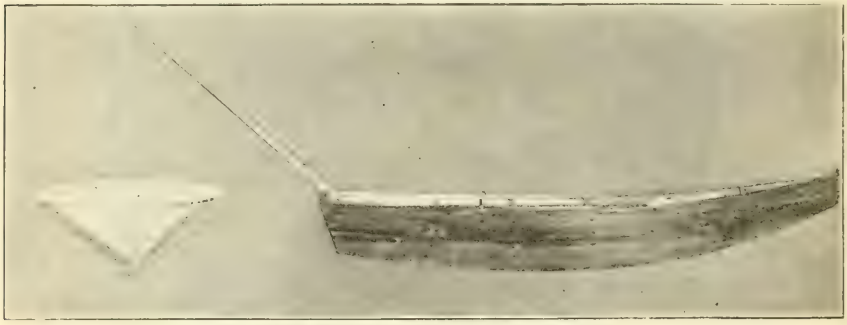


FIG. 67.—Lake Mälaren fishing skiff.

strength is not specially required. The rowlocks, of which there are four, are made of wood. They are semicircular on one side and concave on the other. The convex side, in which is cut the oar rest, is put upward, while the concaved side rests on top of a timber, the horns coming down inside and fastening to the boat's plank.

The relative dimensions of the boat are as follows: Length, over all, 20 feet; width, 5 feet 7 inches; depth, 16⅝ inches.

Lake Mälaren fishing skiff.—On Lake Mälaren a flat-bottom, square-ended skiff (fig. 67) is used for operating a hoop-net ("sänk-haf"), that is sunk to the bottom by a leaden weight and its metal hoop, and is raised by a small winch placed near the heel of the pole projecting from the boat's stern, through the end of which passes the line by which the net is managed.

This punt has slightly flaring sides; is nearly as wide at the stern as amidships; a strong camber to the bottom, especially forward; and a narrow bow. It is propelled with two oars, and underneath the rower's seat is a box for holding the fish taken.

The relative dimensions of one of these fishing punts and the net are as follows: Length over all, 15 feet 8 inches; beam, 4 feet 7 inches; depth, 20 inches; oars, 9 feet 1½ inches; pole, above stern, 8 feet 5 inches; diameter of net, 5 feet 8½ inches.

This punt is a fair example of the flat-bottomed boats used on the smaller lakes. These are called "ekor" (a name taken from "ek," the Swedish word for oak), and Dr. Lundberg has pointed out the fact that they were "originally hollowed-out oak trunks." Remains

FIG. 68.—Dalelven fishing boat. (After Dr. Lundberg.)

of these old dugouts have been discovered in the present century, and it is not uncommon for them to be found in the mud at the bottom of lakes when the latter are drained.

River boats.—Long, narrow, clinker-built, sharp-ended boats are used on the Torne and Kalix rivers in Norrbotten. These are light in construction and are considered especially suitable for the passage of the rapids (figs. 68–69).

Apparatus of capture, etc.—The appliances for the capture of fish and other marine animals in Sweden are perhaps less varied than

FIG. 69.—Torne River boat. (After Dr. Lundberg.)

those of Norway. Nevertheless they are too numerous for full discussion here, as it is not feasible to deal with the subject at length, nor is it considered essentially necessary to do so for the purposes of this report, even though the data is available, for many forms of gear are so generally used and so well known that little new can be said of them.

In a country like Sweden, where the herring, mackerel, eel, lobster, and salmon fisheries are so generally and extensively prosecuted, it

follows that nets, seines, fykes, traps, and pots constitute the most important apparatus of capture, even though the different forms of hand-line gear may claim attention. There is no fishery for marine mammals except that for seals in the Gulf of Bothnia, hence the appliances under this head are less important than those of some other countries.

Sealing apparatus.—The appliances used in hunting seals aside from the boats, consist of a heavy gun, a long-handled spear, and a sort of broad wooden snowshoe, called "skida," which the hunters push forward over the ice when approaching seals, and across the forward end of which is erected a canvas screen and rest for the gun.

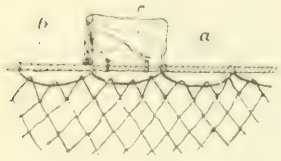


FIG. 70.—Method of hanging herring net (*b*) upon headline (*a*), and fastening float (*c*). (After Dr. Lundberg.)

Nets and seines.—A large variety of nets and seines are used in the Swedish fisheries. These are usually made of cotton and linen. Of course the greater number are herring gill nets used both in drift-net and standing-net fisheries. For instance, at Bohuslän alone 5,410 gill nets were used in the drift-net herring fishery in 1896. The nets used in the herring fishery of the Cattegat are called "nardingar," and they are hung to the headrope, as shown in figure 70, the hanging line being rove through three meshes and then fastened to the headrope. The Baltic herring nets, locally known as "mansor," used in the strömming fishery, are hung quite differently, the upper border of the net being some distance from the cork rope, to which it is held by small lines placed at intervals along the head of the net, figure 71.

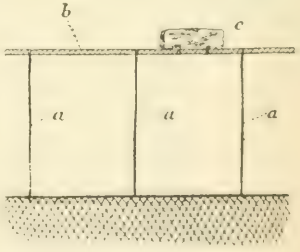


FIG. 71.—Baltic herring net. (After Dr. Lundberg.)

From the northern part of the Stockholm archipelago and upward past Öregrund and the coast of Norrland, the ordinary construction of the strömming-net begins to be replaced by a larger and much deeper kind of net, called "djupskötar" or "storskötar," originally introduced from Finland. These nets are from 35 to over 70 meters in length and from 7 to 15 meters in depth. It is here a very usual thing to set the net "i krok" (in a crook); that is to say, the outer net is turned back so as by that means to form an angle with the remainder of the net. In this crook they not seldom make rich catches of several barrels of strömming at once.[1]

Cod nets similar to those of Norway, but usually of a smaller mesh, are used, these being generally fitted with glass floats, as is common in Norway and elsewhere.

[1] Fisheries and Fishery Industries of Sweden, pp. 23–24.

Stake gill nets are used for salmon at and near the mouths of rivers, as has long been the custom in Norrland.

For fresh-water fishing various kinds of nets are used, these being adapted to the different species of fish sought. While the ordinary gill net may be most numerously employed, the trammel net "skottnat"—is much in favor for fishing on reedy bottom near the shore, where it is pushed out by a pole, after which the fish are frightened into the net by striking on the water with a pole having a knob at its outer end.

The sinkers and floats used on gill nets in certain sections of Sweden are interesting objects of study. I found that among the nets exhibited at Bergen many had floats made of birch bark tightly rolled together. Some floats were made of wood and some of cork, but

FIG. 72.—Seining herring (From Swedish drawing.)

others of thick buoyant bark. Stones, bones of animals, gravel inclosed in birch bark, and pieces of iron were among the materials used for sinkers. In some places it appears stones are not obtainable of suitable size and form for net sinkers, therefore the fishermen avail themselves of other materials which will serve the purpose.

At Kuggorn the cork floats are somewhat irregular in shape, as is practically always the case when they are prepared by the fishermen. The general form is ovate, but some are round at one end and square at the other, and vary in other particulars. These floats have a hole near one edge, and a line passing through this and around the head rope attaches them to the net. Stone sinkers are used.

Both drag nets and purse seines are used in the herring fishery. It is a common thing for a large school of fish to be stopped in an arm of the sea or estuary by setting a seine across its entrance, after which the fish are pulled to the shore, as required, with another seine (fig. 72).

The purse seine is made after the pattern of the American net of that kind, and is fitted with cork floats, bridle lines, rings, and purse line, as in the United States, where this form of apparatus originated.

Haul seines are used in lake fishing, and these are usually provided with a pocket or bag in the bunt, into which the fish are gathered when the net is dragged on shore. Some of these seines are of the ordinary form, and do not have the pocket.

"But two that are peculiar," remarks Dr. Lundberg, "are the so-called 'spiller' seine (spila=spjäla=thin wooden laths), which is used in Helsingland, and 'segel' seine (segel=sail) from Skåne. The peculiarity of these is that the gullet or 'cod'—the net bag, provided with floats—is the chief part of the net, and the arms or wings are either short or are altogether wanting, being replaced by wooden laths or bunches of straw, which are fastened to the draw lines and which frighten the fish from turning off to the sides. These seines are rowed between two boats out in the lake. When the fish are to be secured the boats row toward each other, so that the draw lines cross, and the

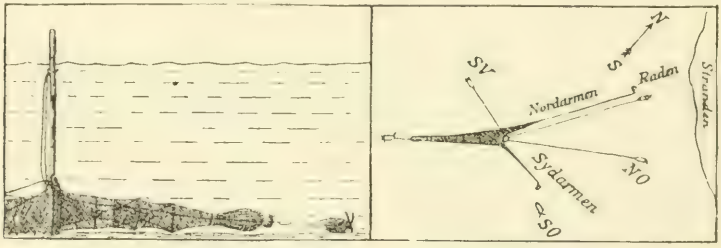


FIG. 73.—Råå eel trap: plan and elevation. (After Dr. Lundberg.)

seine is taken into the boats. In Norrland they use a kind of seine without a cod, called 'ena.' The same kind of thing is used in the district of Kalmarlän and is called 'damp' or 'dämp.' They are put out between two boats, of which the one rows in a circle which becomes gradually less until the boats approach each other, when the seine is taken up. The gear which is used in Wettern, under the name of 'strö' or 'strö' net, for catching char, is managed in the same way."[1]

Fykes, traps, weirs, etc.—Fykes and fyke traps are extensively used in the eel fishery, and generally in connection with an eelpot, which is placed at the end of the fyke. An eel trap of this kind, used at Råå (fig. 73), has an eelpot at its extremity attached to a stone killick, which holds it to the bottom. It is further fastened by a ring and line to a post or stake which projects out of the water, and is lifted by the line referred to. It has long wings, one longer than the other, extending toward the shore, so as to intercept eels passing along the coast and direct them into the fyke. This kind of fyke is designed for use on a weedy or grassy bottom in the Sound, but a different form is used

[1] Fisheries and Fishery Industries of Sweden, pp. 59–60.

on shallow, sandy bottoms, like those along the coast of Skåne and Blekinge (fig. 74). The apex of the latter is extended by a stone with a line reaching to a buoy on the surface, so that it can be lifted. The longer wing is 18 fathoms, the shorter 4 to 5 fathoms, while the fyke

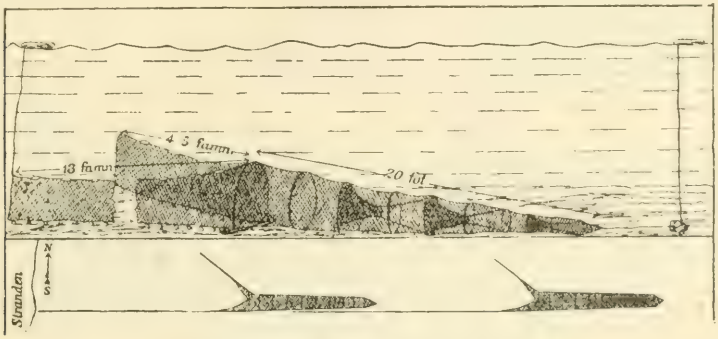


FIG. 74.—Skåne eel trap. (After Dr. Lundberg.)

part from outer hoop to net is 20 feet. These fykes are usually set tandem, the long arm of the inner one extending to the shore, while the longer wing of the next one laps by the first.

"The remarkable thing with these eel traps," writes Dr. Lundberg, "is that with all their differences they have one thing in common, namely, that they are placed with the opening to catch the eels in one direction; for example, on the east coast for the eels that go southward, and in the Sound with the opening in the other direction."

Many forms of traps, or bow nets, are used in the lakes, and it is stated that those employed in Lake Wenern for the capture of pike perch are comparatively large. Bow nets, or fykes, used for catching eels in the lakes, often have an entrance at each end, with an eelpot attached, but often there is only one eel bucket. These pots are made in various ways. Some of them are constructed of wooden splints, bound together with bast, and others are of netting. For details of construction see chapter on pots.

FIG. 75.—Halland salmon weir. (After Dr. Lundberg.)

A more peculiar kind of fishing gear is the fish trap (S. katsa) which is made by binding together long, thin, perpendicularly cloven wooden laths (as those of venetian blinds). These then form a chamber from which the fish can not make its way out when once it has entered. The fish is led to the "katsa" by a shore wing, which is fastened to the land, and which is constructed in the greatest measure of piles and brushwood in order to save material. The "katsa" must be placed in position while the water is still ice covered. The fish captured is removed by means of a landing net specially made for the purpose.[1]

[1] Fisheries and Fishery Industries of Sweden, pp. 60–61. The form of fish trap thus referred to by Dr. Lundberg is similar to that described and figured in the chapter on Finland.

A sort of salmon weir, nearly oblong in form and held in position by anchors at each corner, is used at the mouth of the Rönne-ån River on the northwest coast of Skåne. This is a simple device, and very similar in form to the cod traps used on the coast of Newfoundland. The heart-shaped salmon weir ("Laxa satt") used on the coast of Halland (fig. 75) is a more effective device, but still is far inferior to the salmon traps employed in this country, and evidently less effective than the

FIG. 76.—Great Finlandian fish trap from coast of Helsingland. (After Dr. Lundberg.)

Finland fish trap used on the coast of Helsingland for catching the gwyniad and other species (fig. 76).

Various forms of traps and weirs are used for salmon fishing in the Swedish rivers, and have been used from time immemorial. Among these, of which models were exhibited, is the so-called "tin-byggnader" (fig. 77). It is a fixed apparatus, built of timber and sunk in the river by ballast, and has baskets or pots into which the salmon may run. These conical baskets are made of wooden laths and brass wire and are

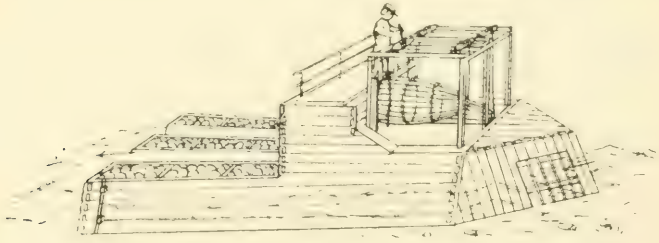


FIG. 77.—Salmon trap in the Ume River. (After Dr. Lundberg.)

provided with a four-sided funnel entrance. A number of these are placed in wooden cassions, like that just mentioned, which are sunk in the rapids of the river.

Another kind of trap is that called "laxminor" (salmon mines) which are large erections shaped like river locks and with the upper end provided with double falling sluices, the inner one supplied with bars, the outer one not so; the lower end of the lock is furnished with barred sliding gates which are pulled up to allow of the entrance of the fish, which are prevented from further progress at the top end by the barred sluice doors. When the fish are to be removed, the lower barred flaps are closed, as are also the upper, outer, close falling sluices. The water then runs

off and the fish inclosed in the "mine" can easily be removed by means of landing nets or smaller seines. Such erections are found at the sawmills of Baggböle (fig. 78) on the river Ume and at Deijefors on the Klarelfven in Wermland. A kind of pile erection or "pens," of enormous size but of varying dimensions, is used in our more northern rivers, the Torne, Kalix, Ume, and, of late years, in the Ljungan also. They have a Finnish name "pata" (pl. pator) and the four-sided chamber itself, in which the salmon is taken, is called in Finnish "karsina." The accompanying sketch-plan (fig. 79) shows such a pata from the river Ume. The arrows give the direction of the current. The fish is guided by the shore arm (170 meters) to the entrance, moves against stream to the upper short side (gafveln = gable) and stubbornly remains there. When the fish are to be secured, the entrance is closed by means of a net, and seine attached to two boats is drawn up to the upper gable toward a net fastened there so that the salmon are taken between the two. The length of the long sides of the "pata" shown is 50 meters; that of the shorter sides, from 20 to 30 meters. A net arm leads down stream from the lower gable, which is intended to turn the salmon into the pata. These erections for salmon fishery vary both in size and in method of construction. The walls are sometimes of piles and plaited twigs (as on the river Torne), sometimes with a kind of ladder or gate-like bar work between the piles, and sometimes of coarse nets of hemp (on the river Lule) (fig. 80). It is of the utmost importance that the pata should be placed correctly in respect to the direction of the current, in order that the catch may be good; when this is successfully done the results are enormous. A good daily catch in the river Torne amounts to several hundred salmon, and it has happened, although rarely, that as many as

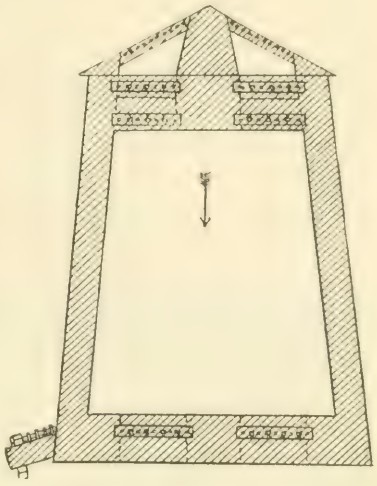


FIG. 78.—River Ume salmon mine. (After Dr. Lundberg.)

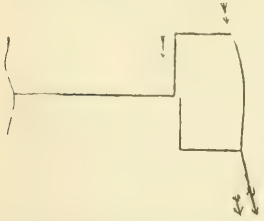


FIG. 79.—Salmon pen on Ume River. (After Dr. Lundberg.)

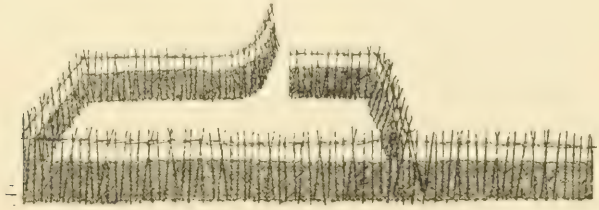


FIG. 80.—Salmon trap on Lule River. (After Dr. Lundberg.)

1,000 fish have been taken in twenty-four hours from a single pata in the river we have mentioned.[1]

[1] Fisheries and Fishery Industries of Sweden, pp. 50, 51.

Trawl lines.—Long lines, or trawl lines, are used for the capture of many species of fish in Sweden. They differ only slightly in the matter of rig, the chief variation being in size of lines, hooks, length of snoods, etc.

In all cases, however, the system of placing the hooks when not in use is essentially the same. The receptacle for holding these is a wooden device of suitable length. One part is flattened, has a longitudinal saw cut sufficiently wide to take the hooks, and is worked into a handle at one end. Fastened above this near the handle, by a bolt upon which it turns, is another wooden part that may be designated as the cover. When the hooks are being fixed in place this is turned back, but when

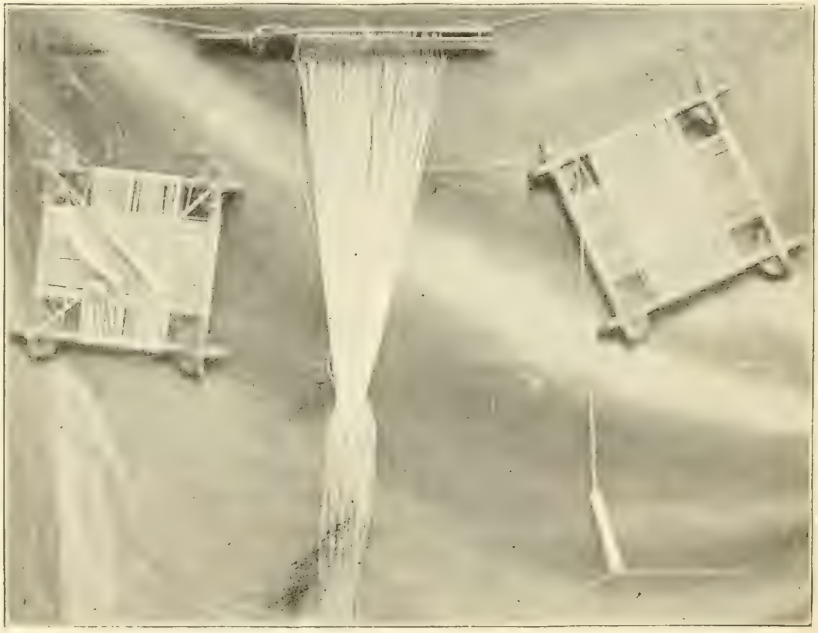


FIG. 81.—Eel trawl and hand lines.

they are arranged the cover is swung over them and is held in position by a cord tied around the outer end. This makes it practicable to carry a trawl line without fear of entanglement.

The illustration of an eel trawl (fig. 81) shows the apparatus for holding trawl hooks.

Hand-line fishing appliances.—Various forms of hand-line gear are used for the capture of fish in Sweden, but they are not so numerous nor so varied as in many other countries, since most of the fishing is done with nets, seines, pots, and traps. It is practicable to mention only a few forms.

Codfishing gear.—The most common form of hand-line gear for cod that was exhibited consisted of a tarred hemp line, wound on a

square reel (fig. 81); a lead sinker, nearly square in cross section, 5¼ inches long and 2 inches greatest diameter; through the center of this is a straight brass-wire spreader, 23 inches long, bent into an eye at each end to receive the snood. The snoods are each 5 feet long; hooks, 3⅜ inches long, with 1⅛-inch spread.

At times, when bait is not obtainable, a fish-shaped, double-hooked jig, varying from 4 to 5½ inches in length, is used for catching cod, this being fastened to a small hemp line about the size of a small pollock line (Pl. XXX). The jig is simply pulled up and let down (like a squid jig) to make it simulate the movements of a small fish. If cod gather around it they are liable to be hooked. Substantially the same form of gear is employed in Norway and Newfoundland. It is also used for catching herring.

Whiting lines.—The hand-line gear used for catching whiting (fig. 81) consists of a small hemp line, about the size of a large mackerel line, wound on a square oak reel. The lead sinker is somewhat flattened, though nearly square in cross section, 3⅝ inches long and five-eighths inch in its greatest diameter. The upper end is compressed and the line is bent through a small hole made for the purpose. A spreader of brass wire passes through a hole in the lower end of the sinker and is bent so as to reverse the direction of its ends, which are flattened. It spreads 11½ inches. To each end of the spreader is seized a small black linen snood, 26 inches long; the lower end is bent into the eye of a small hook 1¼ inches long.

Another interesting hand-line gear for whiting fishing is illustrated on Plate XXX. This consists of a line made of black hair (presumably horse hair) knotted together in short sections, and wound on a square wooden reel. Attached to the lower end of the line is a white gut (or hair) snood or leader, the lower end of which is bent into the eye of the lead sinker, which is of a conventional form—long and cylindrical, with the upper end flattened and pierced with a hole to receive the line. Thirteen small galvanized hooks 1⅝ inches long are bent to the leader at intervals of about 6 inches by gut gangings, each 3 feet long. This gear should be very effective in a slight current, even if the line itself is primitive and suggestive of a lack of adequate appliances for prosecuting fishery.

Lake fishing gear.—The gear used in winter fishing through the ice on the lakes (fig. 82) is chiefly interesting because of the peculiar hook, with its long angular bend and point curving in toward the shank. In using this a pointed stick, with a notch at its top and a spool-like line reel fixed to its side, is firmly embedded in the ice in a vertical position and near to a hole cut through the ice. The line passes through a ring, metal eye, or hole at the small end of a pole of proper length, which is placed in the notch of the upright stick, so that the heavier end is

inside and will slightly overbalance the other. Thus when a fish bites and is hooked the strain on the line tips the pole and warns the waiting fisherman, who may be watching several such devices, that his attention is required.

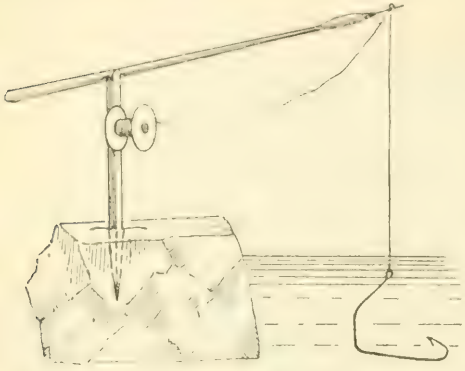


FIG. 82.—Ice fishing tackle. (After Dr. Lundberg.)

Among the exhibits of Sweden were an ice-fishing sledge, equipped with axes for cutting ice, and other accessories required for winter fishing on the lakes.

In addition to the above-described gear, a decoy jig hook, having a piece of red rag attached, is used for catching perch through the ice.

Hand-line horns.—In Sweden, as in other Scandinavian countries, it is common for the hand-line fishermen to use a peculiar device for lessening the friction when hauling the line. This consists simply of a cow's horn fastened on the convex side and nearly in the center to a wooden stick, which is shaped so that it can be stuck in a thole pin hole or in a hole made for the purpose in a boat's gunwale. When so arranged, the concave side of the horn is up (Pl. XXX), and a line can be drawn over or across it without slipping off the ends. The horn on one exhibited was 8 inches long and the wooden pin 11½ inches long.

Pots.—Many kinds of fish pots and fish baskets are used in Sweden, mostly in connection with fykes and hoop nets, as already mentioned. A more detailed reference to them will, however, be made under this head.

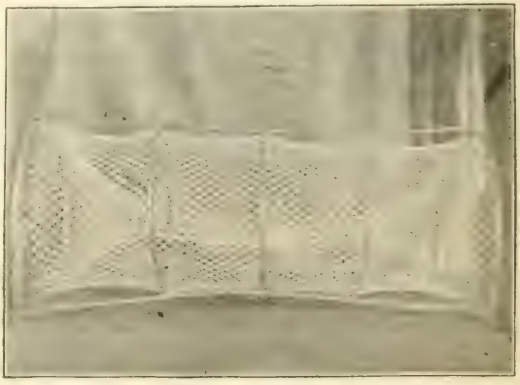
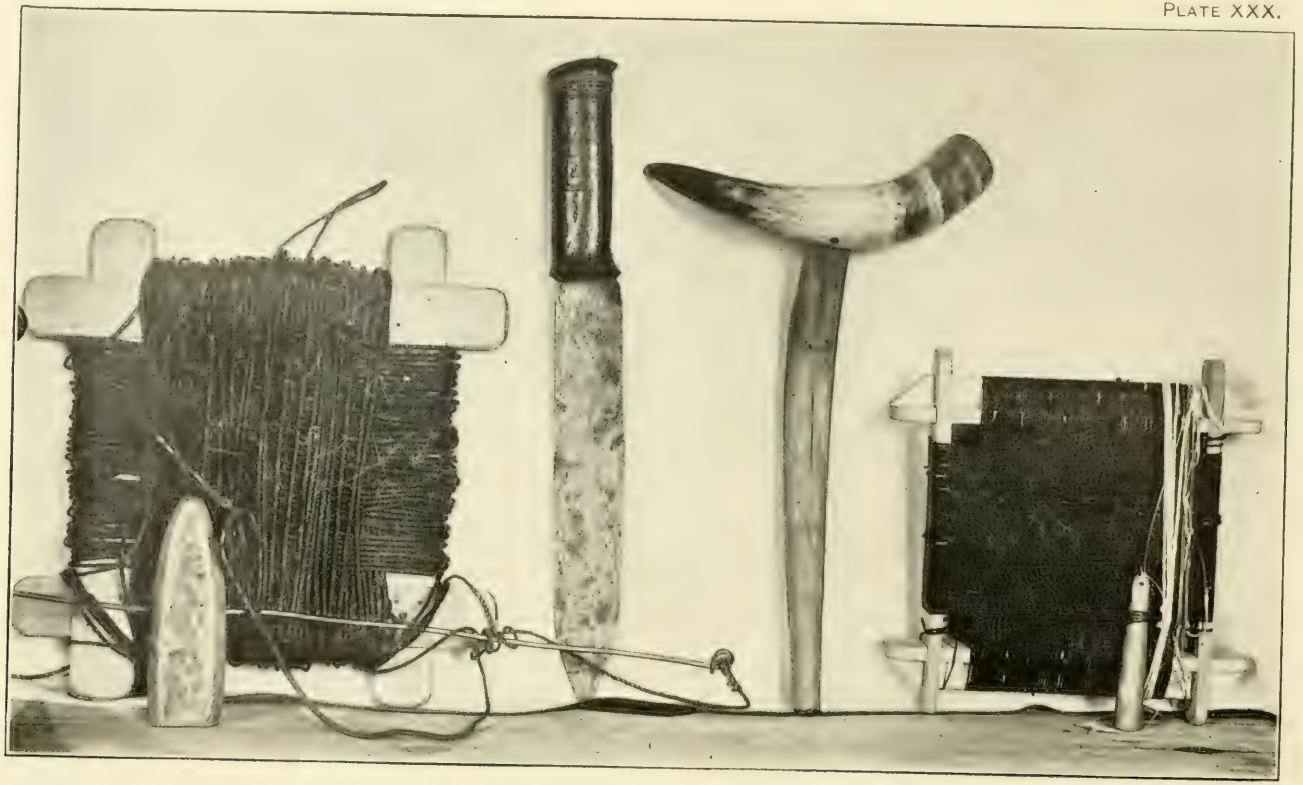


FIG. 83.—Lobster pot.

Lobster pots.—The lobster pots employed in Sweden are cylindrical in form with an entrance at each end (fig. 83). They are constructed of netting stretched over a wooden framework, are light and easily handled, but less enduring than the lobster pots used in the United States. Wooden strips about the size of a lath, but generally somewhat thicker, extend longitudinally outside of the netting at intervals of about a foot. These protect the netting from being chafed on the bottom.

The common method is to set them tandem, or "trawl fashion," as



FISHING LINES, KNIFE, ETC

it is called in Maine, which enables a fisherman to operate many more pots than if they are set singly.

Fish baskets.—A form of fish basket used in the lakes (fig. 84) is made of bast woven into the form of a net and stretched over a wooden framework; it is square in cross section. This pot has a funnel-shaped entrance at one end and an adjustable door of birch bark at the other. It is 34 inches long and 16 to 17 inches square.

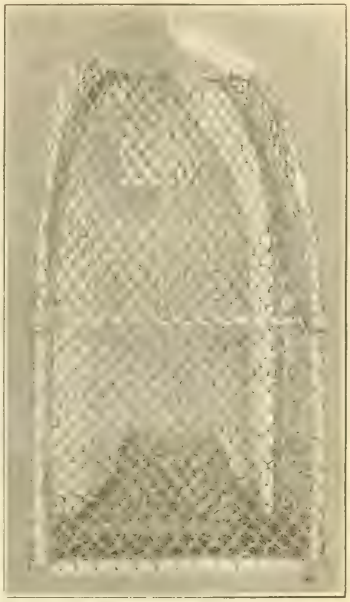


FIG. 84.—Fish basket.

The wickerwork fish basket (fig. 85) is circular in form, with a funnel-shaped entrance, and the osiers at the opposite end drawn closely together. It is 34 inches long and 17 inches in diameter.

A fish pot, made of thin strips of tough light wood (fig. 86), is used to a considerable extent. The splints are held to hoops with twine wound around them. The pot is circular in cross section and is much smaller at the outer end than at the entrance. It has a funnel-shaped entrance made of splints. The end opposite the entrance is 6 inches in diameter, and is covered with netting secured to the outer edge of the pot, and drawn tight at center with a puckering string, which may be loosened to remove the catch. This kind of pot, which is locally known as a "splat-work weel," is 2 feet 6 inches long and 17 inches in diameter at the mouth.

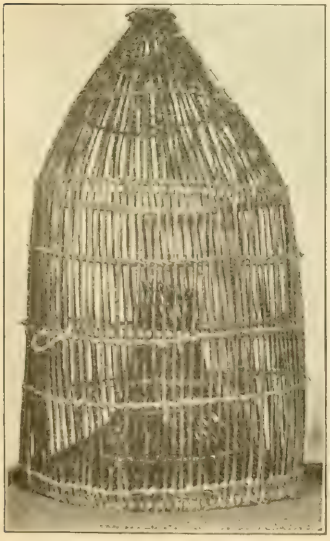


FIG. 85.—Fish basket.

A junket, or pot, for catching perch, exhibited by Mr. C. Johnson, is shown in figure 86. This consists of cotton netting drawn over a wooden frame and having a funnel-shaped entrance. The total length of frame is 3 feet 6 inches; length of that part covered by netting, 2 feet 9 inches; greatest diameter, 18 inches; depth of funnel, 1 foot; size of mesh, 1 inch.

Eel pots.—The most common form of eel pot, or basket, used with the fyke net (fig. 87), was exhibited by Mr. Nils Svenson. This is made of willow resembling the red osier, and

is very strong and durable. It has a narrow, funnel-shaped entrance at one end and an eye for a grasp at the other. On one side is an adjustable door. This device is 3 feet 6 inches long; greatest diameter, 1 foot; diameter at mouth, 7½ inches; length of funnel, 14 inches.

Lamprey pots.—In some of the rivers of Sweden the lamprey (*Petromyzon fluviatilis*) is an object of fishery. According to Dr. Lundberg it is caught in a kind of conical tube or weel with a funnel-shaped entrance with a hole at the end which is closed by means of twigs, etc. These "nätting stockar" or "tinor" have either been roughly hewn out of a cloven, hollowed tree-trunk whose two parts are then joined

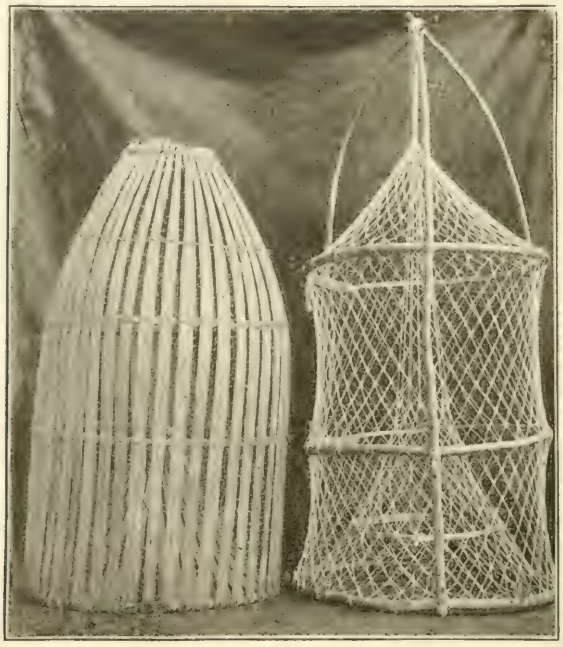


FIG. 86.—Fish pots or junkets.

again and provided with bored holes for the escape of the water (fig. 88) or, as in the river Dal, are made of broad wooden laths (fig. 89). These traps are placed in the river between stones close to the shore.[1]

Crayfish pot. The crayfish is caught in a small wickerwork basket, circular in form, with a broad, flat bottom and a narrower top, with a funnel-shaped entrance, made of birch bark (fig. 90). It has a bail, or handle, made of osier, for lifting it. The one exhibited was 9½ inches high, 13 inches greatest diameter, and 6 inches wide at the entrance.

The crayfish (*Astacus fluviatilis*) occurs in central and southern Sweden, and is found in considerable numbers in many places. The

[1] Fisheries and Fishery Industries of Sweden, p. 57.

pots, locally known as "burar," are sometimes made of plaited steel wire, with funnel-shaped entrance like that already described.

Killicks and grapnels.—Both stone and iron killicks, or anchors, are used for anchoring nets, boats, and trawl lines. These differ only in detail from those of other countries.

FIG. 87.—Eel pot.

Knives.—The large, pointed knife, shown in Plate XXX, is in common use for cutting bait and for other purposes connected with the fisheries. The blade is about 10 inches long; handle, 5 to 6 inches in length.

Buoys. Solid wooden buoys are in common use on nets, as are also keg buoys. These are of various sizes, and many forms, but are usually nearly cylindrical in cross section and with one end about half the diameter of the other.

An ingenious device (fig. 91) has been adopted by the Swedish fishermen to enable them to find their nets and long lines in foggy weather. Having taken the bottom out of an ordinary beer bottle, and having fastened a metal clapper inside, they attach the bottle by a galvanized iron, made especially for the purpose, to the staff of the buoy just above the latter. Thus the least motion of a wave will make sufficient noise in the bottle to be heard a farther distance than the buoy can be seen in thick weather, if the wind is moderate. A wooden buoy of this description was exhibited. This was about 2 feet long, with a staff 5 feet 9 inches long weighted at the bottom with metal.

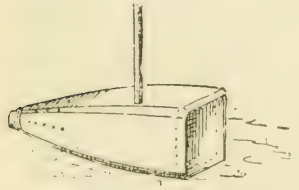


FIG. 88.—Lamprey weel. (After Dr. Lundberg.)

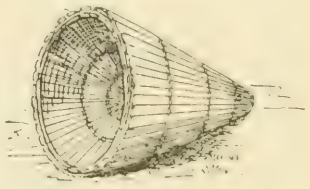


FIG. 89.—Lamprey trap. (After Dr. Lundberg.)

Water telescope.—A water glass, or water telescope, is used in the fisheries of Sweden for discovering schools of fish—especially herring—that may be passing, and can not otherwise be seen, when a breeze ruffles the surface of the sea. It is similar to forms employed for the same purpose in other countries, and consists of a tapering tin cylinder painted black, with the smaller end open and a glass set in the large end (fig. 92). It is provided with two handles near the small end for the observer to grasp when watching

for fish, at which time he puts the larger end into the water and pushes his face into the other, or open, end, so as to shut out light from above and enable him to see more clearly into the aqueous depths. It is 26 inches long, 7¼ inches in diameter at the large end and 4¼ inches at the other end.

FIG. 90.—Crayfish-pot.

Steam winch.—An improved form of steam winch, intended primarily for use in loading and discharging cargo, was exhibited by the Göteborgs mekaniska Werkstad, of Göttenberg. This appeared simple in construction, strong, and well designed for doing the particular kind of work for which it was intended. The style of this winch is shown in figure 93.

FIG. 91.—Bell buoy.

Fishermen's bark shoes.—In some parts of Sweden shoes made of birch bark are worn by the fishermen and their families, and the same is true of some other countries of northern Europe, including Finland. A pair of these shoes exhibited were made of strips of birch bark 1¼ inches wide, woven together as shown in figure 94. These were made with a double thickness of bark, so that the cross pointing is the same on the inside as on the outside.

Methods of fishing and fishing stations.—Sweden exhibited a number of drawings and photographs illustrative of methods of fishing and coast-fishing stations. Figures 95 and 96 illustrate, respectively, the methods of fishing with set gill nets (for herring) and purse seines.

The method of preparing herring gill nets for setting, by putting on the sinkers and stowing them in a boat, is shown in the view of Kuggörn (fig. 97). The process of taking herring from nets is an interesting one, and is indicated in a view at Kråkön, near Göttenberg (fig. 98).

FISH HOUSES AND FISHING BOATS AT HUDIKSVALL.

The illustrations of fishing stations are instructive and convey an idea of the conditions under which the fisheries are prosecuted that could not otherwise be so well obtained.

The fishing villages along the coast of Sweden are often no more than collections of rude board shanties, which, however, afford the necessary shelter. The character of these stations, which closely resemble some of the fishing hamlets on the coast of Newfoundland, is shown in the accompanying views of the fishing villages of Agö and Skärså (figs. 99, 100).

FIG. 92.—Water glass.

The conditions at Hudiksvall, however, are quite different, as indicated by the illustration (Pl. XXXI). This town is situated in the central section of the Swedish coast, and is a place of considerable importance.

Fish-packing establishments and accessories.—The fish-packing houses at Hudiksvall are not materially unlike those used in some parts of the United States, and indicate a prosperous fishery.

The boats are, for the most part, open, square-stern, clinker-built craft, with two loose-footed standing lugsails. They vary from 17 to 25 feet in length.

Oil and guano factory.—The manufacture of oil and guano is carried on to a considerable extent in Sweden, and several paintings and photographs of such factories were exhibited. One of these, Kallviken's establishment at Dragsmark, is shown in plate XXXII.

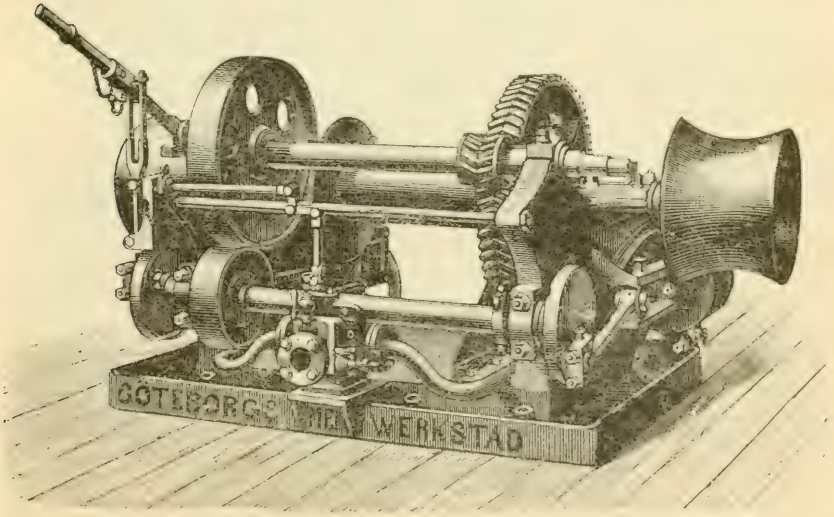


FIG. 93.—Steam winch. (From Swedish print.)

In the early nineties the abundance and consequent cheapness of herring caused something like a boom in the manufacture of oil and guano. So pronounced was the movement in this direction that the factories increased from 3, in 1891, to 22, in 1895. The total value of all these plants is variously estimated to be from about $540,000 to upward of $8,000,000, in round numbers. It is claimed that the daily output of these establishments amounts to 164 tons of guano, while the product for the season of 1895–96 reached a total of 12,299 casks of oil and 14,169,580 kilograms of fertilizers. In producing these, 853,958 hectoliters of herring were used. The success of this enterprise depends, however, upon the cheapness, as well as upon the abundance of fish, and the high price of herring in recent years—1897, 1898—has nearly stopped the manufacture of oil and guano for the time being.

FIG. 94.—Fisherman's birch-bark shoes.

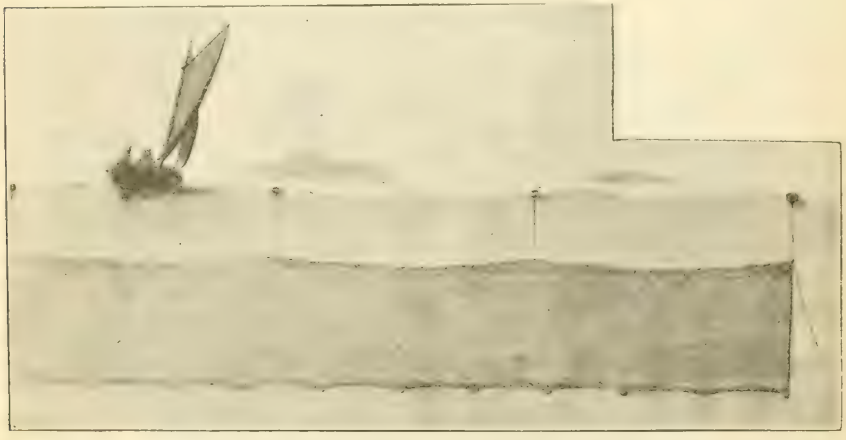


FIG. 95.—Gill-net fishing. (From Swedish drawing.)

The barrels used for fish packing are of the ordinary form, with wooden hoops (fig. 101).

Among the most interesting accessories was an apparatus for rolling casks or barrels, exhibited by Beckman & Johnson, of Göttenberg. With this device a man can walk erect and roll one or several barrels

OIL AND GUANO FACTORY AT DRAGSMARK

with comparative ease, instead of being compelled to do the work in the usual laborious way by stooping and pushing the barrel ahead of him. The apparatus consists of a simple iron clamp which can quickly

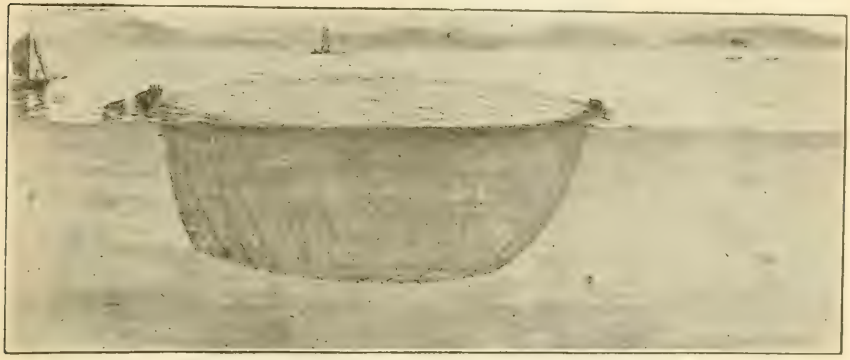


FIG. 96.—Purse-seine fishing. (From Swedish drawing.)

and easily be adjusted to a barrel and it is so arranged that it revolves on the bolts attached to the hauling part.

Fish products.—The fish products exhibited consisted chiefly of klipfish, salted herrings, both cured in the ordinary manner; smoked salmon, dried fresh-water fish, dried smelts, fresh salmon, and other

FIG. 97.—Taking gill nets on boat at Kuggorn.

fish on ice, and various kinds of canned goods, including cod's tongues, anchovies, put up in various ways; herring packed in different forms, and oil of several varieties, but chiefly herring and anchovy oils.

Fish culture.—A model of a salmon hatchery was exhibited by

FIG. 98.—Picking herring nets at Kråkön.

K. J. Strom; drawings and maps of the hatchery and fish ponds at Engelsberg by the Engelsberg Piscicultural Company, and models of

FIG. 99.—Fishing village of Agö.

salmon hatcheries and of a fishway were shown among the collections from the Stockholm Fishery Museum.

Concerning the progress of fish-culture in Sweden, Dr. Lundberg makes the following statements:

Sweden was probably the first among European lands to endeavor by means of special measures to promote the hatching of fish spawn with the intention of thereby

FIG. 100.—Fishing village of Skärsä.

improving the fisheries. As early as 1761 the mayor of the town of Linköping, C. Frederick Lund, published an account in the Proceedings of the Royal Society

FIG. 101.—Barrels, buoys, and nets.

(Swedish) entitled "On the planting of fish in lakes," which was based on experiments made by him in Lake Roxen, in Östergötland. * * * * *

In 1864 an establishment for the hatching of salmon was erected at the cost of the State at Östanbäck on the river Ångermanelfven, at which place also instruction was

given in the method of fructifying fish of the salmon species. The establishment named afterwards served as a model for similar ones in the country. They are usually built of wood and at first had, very generally, wooden troughs with gravel at the bottom, but nowadays hatching tanks of very many modern types are in general use. The number of establishments for salmon hatchery has not been constant, several of the older ones having been closed and one or two new ones being established. At present there are nearly forty of them in different parts of the country. That at Östanbäck ceased to be a State establishment once it had fulfilled its mission to serve as a model for similar institutions.

Our great wealth of lakes capable of supplying us with fish has, together with other circumstances, had as a consequence that the preservation of fish in ponds does not occur here to any great extent. Still this condition of things has somewhat changed of late, so that several establishments of the kind have been erected. The largest are the carp ponds, formed in 1879 by C. H. Wendt, a landowner, at Gustafsborg, near Perstorp's railway station in North Skåne. The area of the ponds is about 400 hectares, which are divided in the following manner:

	Har.
4 spawning ponds	1.97
25 growing ponds	54.30
8 growing ponds for 2-year carp	148.10
4 growing ponds for 3-year carp	187.60

A number of carp are sold when but 3 years old. The greater number are exported to Hamburg. The yearly production amounts at present to about 15,000 kilograms, but when the ponds were new the production was from 20,000 to 25,000 kilograms. Besides carp, tench, pike, perch, and eel are also cultivated, but the carp is the principal object of care. The value of the carp sold during the years 1891 to 1896 amounted, according to the appended table, to the following sums:

	Kronor.		Kronor.
1891	7,145	1894	13,496
1892	14,930	1895	11,204
1893	11,186	1896	20,272

At Engelsberg, in Westmanland, a company has of late years formed a fish-pond establishment chiefly for the cultivation of fish of the salmon family, and at present an attempt is being made there to cultivate on a large scale the rainbow trout (*Salmo irideus*). That the cultivation of carp can be carried on much farther north in Sweden than Skåne is shown by the fact of carp cultivation in ponds being successfullly practiced at the works of Långbanshyttan, in Wermland, in spite of the fact that the place lies in 59° 45′ north latitude and 767 feet (227.7 meters) above the sea level.

Since the year 1890 there has been a fish-pond hatchery establishment, erected at the cost of the Government, at Finspong, in Östergötland, in connection with a smaller fresh-water biological experimental station for the cultivation of fresh-water fish and the bringing up of the fry of such fish in ponds. Numbers of young fish of several species have been supplied to the public for stocking the waters.[1]

DENMARK.

Commissioner.—Mr. Arthur Feddersen, who has long been prominently identified with the Danish Fisheries Association (Dansk Fiskeriforening) and with the fisheries exposition work of his country, was the commissioner from Denmark. His long and varied experience

[1] Fisheries and Fishery Industries of Sweden, pp. 63–65.

not only enabled him to attractively install the Danish exhibits, but made him a most valuable member of the juries of awards.

General considerations.—The collections exhibited by Denmark included materials from Greenland, Iceland, and the Faroe Islands, which for the sake of convenience will be considered with those of the mother country.

The fisheries of Denmark employ a considerable portion of the population of the coast towns, more especially those towns bordering on the Cattegat and Skager Rack. In 1883 it was estimated that 4,300 families lived chiefly by fishing, while 7,000 other families derived subsidiary incomes from fishing, thus making a total of 11,300 families dependent to a greater or less extent on this industry. At the same time boats or vessels employed having decks or wells was estimated at 1,000, while from 4,000 to 5,000 open boats were engaged in fishing.

It is to be regretted that there are no recent statistics available to show the extent of the Danish fisheries and the fishery industries of the islands controlled by Denmark. It may, however, be stated in general terms that Greenland has no fisheries of marked commercial importance.

Such animals as are captured by the Eskimo –mostly marine mammals are generally, if not always, utilized for domestic purposes. The gathering of feathers and down from sea fowl can scarcely come under the head of fishery.

The case is different, however, at Iceland and the Faroes, where fishing constitutes one of the most important, if not the leading, industry of the inhabitants.

Fishing vessels and fishing boats. The fishing vessels and boats of Denmark have a strong family resemblance to those of the Scandinavian peninsula. In some cases they are the same in design, build, and rig, and are used for the same purposes. In many other cases, however, conditions of fishery or environment have led to differentiation, and distinct types have resulted. It is noticeable that Denmark has steam vessels employed in the fisheries, and even as long ago as 1880 the writer met the captain of one of them at Berlin, and was told that this particular vessel was working in the North Sea with an otter trawl, which was then an innovation on vessels of that class. Since then the otter trawl has superseded the beam trawl on the British steam fishing fleet.

It is a noteworthy fact that some of the most important types of Danish vessels employed in the fisheries, considered from the standpoint of size, are freighters, and are usually provided with wells for transporting fish alive from the coast fishing stations to the larger markets, notably Copenhagen.

The fishing boats of Iceland and Faroe, though distinctively of Scandinavian origin, differ in detail from those of Norway and Sweden.

North Sea fishing steamer.—The plans of a yawl-rigged auxiliary screw steam vessel for the deep-sea fishery of the North Sea were exhibited by E. C. Benzon, who, I am informed, for several years has been one of the leading designers of fishing boats in Denmark.

This vessel is illustrated in figure 102. It is a carvel-built, wide and deep keel vessel, with raking curved stem; moderately sharp bow; rising floor; rather short run; straight, vertical sternpost and heavy round stern, with very little overhang. It has a flush deck, forecastle companionway just abaft the windlass; two entrances to the large well (which is more than one-third the vessel's length), and main hatch between them. It has a cabin trunk well aft; adjoining this on the

FIG. 102.—Auxilliary steam-fishing vessel. (Designed by E. C. Benzon.)

forward side is a low engine house. Forward of both is the steering wheel.

The mainmast stands about one-third the vessel's length from the stem, and the pole mizzenmast about 7 feet from the taffrail. The rig consists of a jib set flying on a running bowsprit; stay foresail; boom and gaff mainsail, with high peak; club-headed gaff-topsail; boom and gaff mizzen or jigger, with a small club-headed topsail set over it. It has a single screw propeller, and auxilliary steam power.

This vessel is 50 tons, and is evidently sturdy and seaworthy, but would not be swift compared with American fishing schooners. The chief object sought in the design, aside from safety, is large carrying capacity for live fish; therefore nearly the entire hold in the central

section is utilized as a well for this purpose, and the extra depth of the vessel gives additional room.

Following are the approximate relative dimensions: Length over all, 65 feet 8 inches; beam, 16 feet 2 inches; molded depth, 10 feet; mainmast, above deck, 46 feet 3 inches; topmast, heel to truck, 30 feet; mizzenmast, above deck, 43 feet 2 inches; bowsprit, outboard, 21 feet 5 inches.

Steamer for fishing at Iceland.—A model was exhibited of an auxiliary steam fishing yawl (fig. 103) designed for working off the coast

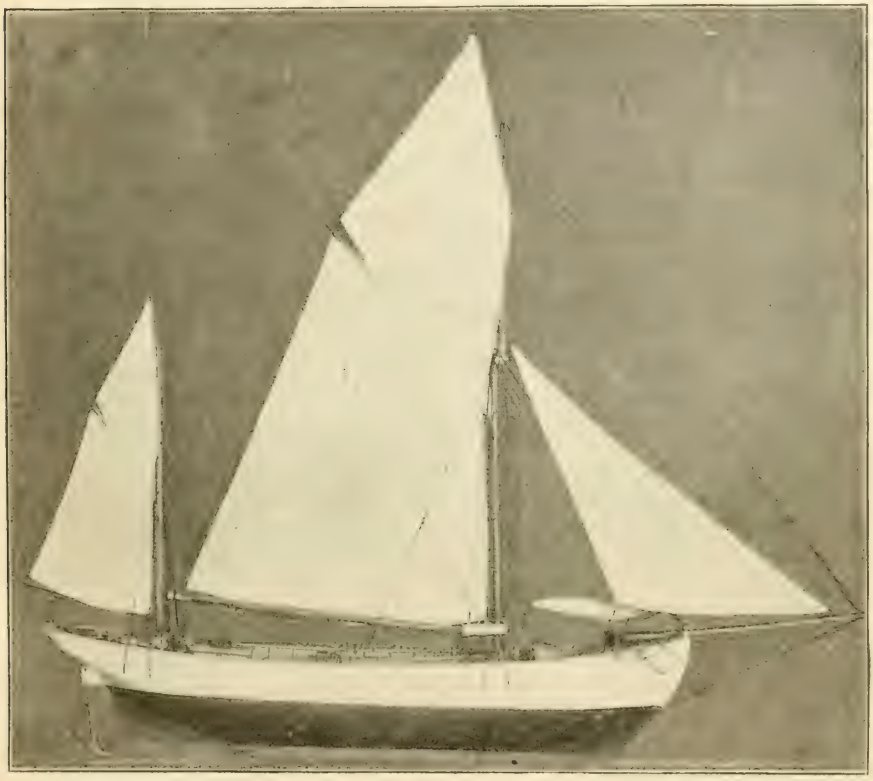


FIG. 103.—Auxilliary fishing steamer.

of Iceland and bringing live fish from there to Copenhagen or other markets. This type of vessel is fitted with a 20-horse power petroleum (kerosene) engine.

A vessel of this kind is carvel-built, with sharp bow; raking curved stem; moderately deep keel; rather sharp floor; easy bilge; short, well-formed run; two-bladed screw; straight, nearly vertical, sternpost; round-heeled rudder and overhanging, round stern. It has a symmetrical sheer, flush deck, and bulwarks from 2 to 2½ feet high. It has a pump-brake windlass which can be operated by steam or hand.

The forecastle companionway is just forward of the mainmast; a small engine house is located forward of the mainsheet traveler; and the cabin trunk is near the stern; the mizzenmast passing through the forward end of it. The wheel is abaft the cabin. This vessel, like that previously described, has a large well for live fish, with two entrances, and the bottom is perforated with holes for nearly half its length to facilitate a proper circulation of water.

The rig is the same as that of the North Sea vessel. It has a running bowsprit and housing topmast. Following are the dimensions: Length over all, 64 feet; beam, 15 feet 6 inches; depth, 7 feet; length of well deck, 24 feet; forward well opening, 9 feet 6 inches by 3 feet; after one, 9 by 3 feet; mainmast, above deck, 37 feet 6 inches; main topmast, heel to truck, 30 feet; main boom, 32 feet 6 inches; main gaff, 25 feet 6 inches; main topsail club, 22 feet; mizzenmast, above deck, 31 feet 6 inches; jigger boom, 15 feet; gaff, 11 feet 6 inches; topsail yard, 17 feet; bowsprit, outboard, 18 feet; boat-shaped, flat-bottomed live car (carried on deck), 16 feet long, 5 feet 6 inches wide, 21 inches deep.

Flounder smacks.—The fishery for flat-fish has always been important from Denmark, and employs a number of sailing welled vessels for carrying the products to market, as well as for fishing.

These vessels are usually about 20 tons, but some are 40 or possibly 50 tons. The fishing boats range from 30 to 50 feet in length, 12 to 16 feet beam, and 5 to 7 feet in depth, and the so-called "purchasing boats"—the smacks that buy and transport living fish—are from 40 to 60 feet long, 12 to 16 feet wide, and 6 to 8 feet deep. The carrying capacity of the wells usually ranges from 2,000 to 6,000 flounders that can be carried alive. One built at Fredrikshaven, of 20 tons, can carry 4,000 flounders.

One type of these small vessels is like the ketch-rigged British cutters, employed in the North Sea long-line fisheries. Indeed, some of this form have been purchased from England and others have been built in Denmark on the same lines. One of these was 50 feet long, 13 feet beam, and 7 feet deep. It was fitted with a large well, as all vessels are for this trade. The tank is generally so large that difficulty was experienced in ballasting the vessels until recent years, when it was found possible to put about 150 pounds of ballast in the well to each ton of carrying capacity of the vessel.

The smacks built at Fredrikshaven are double-ended, decked, keel vessels; wide and deep, with rather full lines; raking stem and sternpost, and slightly hollow rising floor. They are yawl-rigged and are similar in appearance to some of the Norwegian skøite. One of them of 24 tons was 43 feet 2 inches long, 15 feet 4 inches wide, and 6 feet 6¾ inches deep.

A model of a schooner-rigged welled vessel, designed by Mr.

Benzon, for the transportation of living fish, was exhibited. It was a carvel-built, decked, keel vessel, with moderately sharp, flaring bow; raking, curved stem; low, rather flat floor; easy bilge; short run; straight raking sternpost, and heavy, square, non-overhanging stern. It had a fine sheer, flush deck and very large well, this being fully half the length of the vessel, having an immense capacity because of the long and full midship section.

It had a narrow-footed mainsail, foresail, two club-headed gaff-topsails, fore staysail, jib, and flying jib.

This vessel is 49 feet 4¾ inches long, 14 feet 4 inches wide, and 6 feet 5 inches deep.

Mr. Drechsel, in his review of the Danish sea fisheries,[1] makes the following reference to this flounder-carrying trade and the vessels engaged in it, the Danish "handelskvase:"

"The flounder fishery," he says, "is based on the trade with live fish. The catch is stored alive in a tank in the hold and sold in this condition by the fishermen directly on the spot to buying vessels, in which the fish are taken alive to Copenhagen or Norway, or the fish are sold to dealers on shore, who pack them in ice baskets and send them away by rail, mostly to Germany. In recent years it has become customary for the fishermen to bring their catch ashore and sell it to the dealers themselves. This, and for other reasons, as for instance the general improvement in the means of communication, has caused a great decline in this buying traffic that formerly was so very extensive and very remunerative an occupation. At present it is chiefly from Skagen, Anholt, the northern part of Jutland, west coast, and similar isolated places that this trade still is pursued. Such a buying vessel was built by Mr. Benzon in Nykjobing, on the island of Falster. Like all of her type, she is rigged as a fore and aft schooner, long and wide, low and flat amidships, and with a rather high keel. It has been possible to construct good sailers, varying in size from 30 to 40 tons, and with a large carrying capacity, the largest of them taking about 12,000 flounders, weighing on an average of 88 pounds to a hundred fish. The older buying vessels were, up to fifteen or twenty years ago, of the old Danish 'jagt' type, but these vessels were very much inferior, both in regard to carrying capacity and sailing powers. These buying vessels sail their load as a rule to Copenhagen, and the fish are sold from on board the vessel directly to the fish retailers. As the fish are carried alive to this market, and as the Copenhagen people want it so, high prices prevail, as a rule, but this is only natural if we consider the big risk connected with the transportation and storage of live fish."

Herring drift-net boat.- Among the models of decked fishing boats exhibited by Denmark, was one of a deep and wide cutter used in the drift-net herring fishery in the Cattegat (fig. 104). It is a carvel-built, sharp-ended, keel boat, with raking curved stem and sternpost; hollow floor and under-water lines; square-heeled rudder; moderate sheer, and flush deck. It has a large hatch abaft the mast. It has a long running bowsprit, and pole mast about two-fifths the boat's length from the stemhead. The mast has little or no rake. The sails consist of a jib

[1] Overisigt over Vore Saltvandsfiskerier Nordsoen og Farvandene inden for Skagen, etc., ved C. F. Drechsel, 1890.

set flying, stay foresail attached to stay by lacing, boom and gaff-mainsail laced to mast, and club-headed gaff-topsail.

As a rule, the herring boats south of the Sound to Groudsund are decked and others are decked or half-decked.

Following are the dimensions: Length over all, 31 feet; beam, 14 feet; depth, 4 feet 6 inches; hatch, 8 feet 6 inches long, 5 feet 6 inches wide; mast, above deck, 33 feet 6 inches; main boom, 20 feet 6

FIG. 104.—Cattegat drift-net herring boat.

inches; gaff, 16 feet 6 inches; topsail yard, 16 feet 6 inches; bowsprit, outboard, 12 feet 6 inches; oars, 18 feet long.

Skovshoved herring boat.—A clinker-built, sharp-ended, keel boat (fig. 105) is employed in the herring fishery from Skovshoved. It has a curved, strongly raking stem, hollow floor, and water lines; raking sternpost, which curves sharply at the top; square-heeled rudder; graceful sheer; washboards along the sides nearly to the bow, and half-deck aft, with sternsman's cockpit at extreme stern.

It is cutter rigged, with pole mast; adjustable bowsprit; loose-footed sprit mainsail; jib-headed topsail set on pole coming well down the mast; stay foresail and jib.

The dimensions are as follows: Length over all, 25 feet 6 inches; beam, 9 feet 3 inches; depth, 3 feet; mast, above gunwale, 24 feet; gaff-topsail pole, 30 feet; bowsprit, outboard, 9 feet 3 inches; average width of mainsail, 13 feet 6 inches.

Bornholm herring boat.—The Bornholm herring fishery is very important, according to Drechsel, who says that it not only supplies

FIG. 105.—Skovshoved herring boat.

fish for home consumption, but also leaves a large surplus for exportation to Denmark proper and to Germany. Herring is here fished nearly the whole year through by the Bornholm men and by the Swedish fishermen, which latter come here in large numbers during the best part of the season.

"For the herring fisheries," he says, "open boats of a special construction are used, the so-called 'eger,' which are rigged with sprit mainsail, mizzen, topsail, and jib. These boats are built at Bornholm, and are excellent sailers and splendid sea boats. The same kind of boats are used by the Swedish fishermen who have them built on the

island. But they also use the so-called 'blekingseka,' which in shape and size resemble the Bornholm type, but differ in rig, and carrying one big lateen instead of a sprit mainsail. Crew is generally 2 or 3 men."

This herring boat is a wide and deep, sharp-ended, clinker-built, keel craft, with straight raking stem and sternpost. It is 22 feet 9 inches long, 8 feet wide, and 3 feet 5 inches deep.

Bornholm salmon boat.—A clinker-built, sharp-ended, keel boat (fig. 106) is used in the salmon fisheries from the island of Bornholm. It has a sharp floor; stem and sternpost curved above water and

FIG. 106.—Bornholm salmon boat.

raking strongly below; a moderate sheer; flush deck nearly level with gunwale; two hatches forward; a large hatch abaft the mast, and a small cabin trunk aft.

According to the plans published by Drechsel, it is common for boats of this class to have a high stem, and an open rail on a level with the stemhead, running nearly to the stern, as on some of the Norwegian life-saving boats.

"It is only near Bornholm," he says, "that the salmon fisheries require boats larger than the ordinary small open boats. The type is very similar to the Norwegian pilot boats. They are from 6 to 13 tons, without tank, but having a large hold for cargo amidships; they

are provided with a good cabin for the crew and carry also a cooking stove. Rig is mainsail, a small topsail, and two foresails. The first of these boats was built in 1867, in Mexo after plans made by Mr. Benzon, in Nykjobing; later these boats have been built in Bornholm. They are very seaworthy, as has repeatedly been proven when they have been used in winter time many miles out at sea. Lately it has been tried to provide these boats with a small auxiliary engine and propeller, in order to use them for tending salmon gear in calm weather, but the trials do not seem to have been very successful. The crew include, as a rule, 3 men. Besides these boats, open boats are used for the salmon fishing in spring—the same boats that are used for herring."

FIG. 107.—Little Belt eel-fishing boat.

The salmon boat is cutter rigged; carries a narrow, loose-footed gaff-mainsail, club-headed topsail, stay foresail, and jib. The mast is hinged just above the deck, so that it can be lowered.

Drechsel gives the dimensions of one of these boats as 34 feet in length, 11 feet 6 inches beam, and 4 feet 6 inches in depth. The model exhibited represented a boat with the following dimensions: Length over all, 33 feet 9 inches; beam, 10 feet 9 inches; depth, 4 feet 10½ inches; mast, above deck, 34 feet 6 inches; bowsprit, outboard, 9 feet 9 inches; main gaff, 15 feet 9 inches; topsail yard, 10 feet 6 inches.

Drift boats for eel fishing.—In recent years there has been much development in the Danish eel fishery. Formerly it was pursued chiefly to supply local demand, but the advance has been so great that it may now be considered a very important shore fishery, in which are employed many decked boats, which are built in various places, or are

refitted, or changed to adapt them to this fishery. They average about 6 tons. All these boats fish at a drift, dragging a sort of a trawl after them, and a boat engaged in eel fishing is technically known as "drif-krase" or drift boat.

According to Drechsel

The largest of these boats are built from German plans, and go out from Middelfait, Skjierbak, and neighboring places. The special features of these vessels are a sharp and raking bow and a full stern. General rigging is mainsail, with the sheet on a traveler, mizzen, topsail, and two foresails. Aft is a boom for fastening one of the lines of the net while in use. Amidships is a tank, with fine holes, for the storage of the eels. The quarters for the crew, generally 3 men, are aft.

Besides these larger boats smaller ones and open boats are used around the fjords. These are, as a rule, all built with a very flat bottom in order that they may be used in the shallow water where the fishery is done, and in order to enable them to carry sail they are all provided with a centerboard.

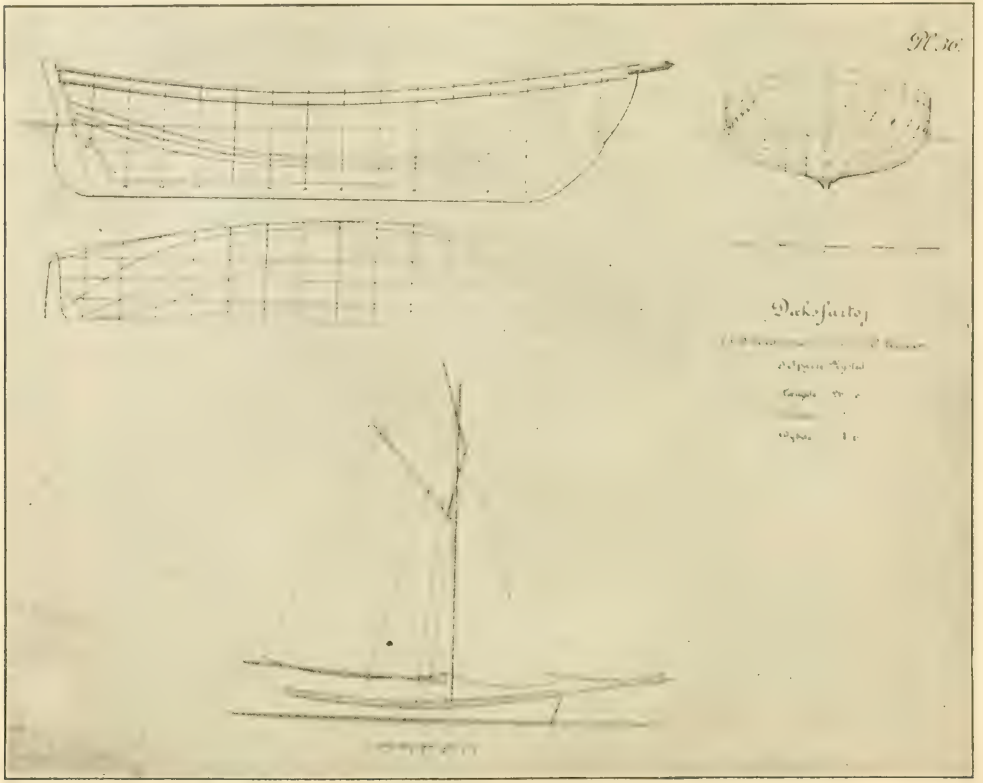
Among the models exhibited at Bergen was a yawl-rigged welled boat (fig. 107) for eel fishing. This represented a wide, shallow, double-ended, clinker-built boat, with shallow keel and fitted with lee-boards. It had curved and slightly raking stem and sternpost; low floor; round bilge; rather full lines fore and aft, and square-heeled rudder. It was half decked forward and aft, with wide washboards along the sides; thus leaving an oblong open space amidships, in which was the well, extending the entire length. It had a cabin forward, with deck house. The lee boards were attached to the mainmast by chains.

It had a fixed bowsprit; a pole mainmast stepped about one-third the boat's length from the stem, and pole mizzenmast close to the stern. It was rigged with jib, stay foresail, loose-footed gaff-mainsail and standing lug jigger; the sheet of the latter is trimmed to an outrigger which also serves to fasten the warp to that holds one wing of the trawl.

Following are the dimensions: Length over all, 24 feet; beam, 8 feet 3 inches; depth, 2 feet 9 inches; length of open space, 7 feet 9 inches; average width, 4 feet 6 inches; mainmast, above deck, 25 feet; main gaff, 11 feet; mizzenmast, above deck, 15 feet 6 inches; jigger yard, 6 feet; boom, 7 feet 9 inches; outrigger, full length, 8 feet; bowsprit, outboard, 10 feet.

Old style fishing vessel.—A small decked vessel of an old type is used to some extent in the autumn fisheries. As figured by Drechsel (Pl. XXXIII) it has a sharp bow; raking curved stem; rather flat floor which is hollow near the keel; easy turn to bilge; flaring side; well-shaped run; square nonoverhanging stern, with rudder outside. It has a good sheer, and a lofty cutter rig, with pole mast about two-fifths the boat's length from stemhead. It carries boom and gaff-mainsail; stay foresail; jib and club-headed gaff-topsail.

The boat is 26 feet long, 9 feet wide, and 3 feet 6 inches deep.



OLD-STYLE FISHING VESSEL.

After Drechsel.

Cattegat fishing boat.—A sharp-ended, clinker-built, decked, keel boat is used in the fisheries of the Cattegat. It is wide and shallow; has nearly straight, raking stem and sternpost; convex lines; rising floor; round bilge; flaring sides; square-heeled rudder—the after part being lowest—and slight sheer. Its deck is flush with the gunwale, and it has a series of large hatches extending nearly from side to side of the deck, abaft the mast, with two small hatches forward of the mast.

It is cutter-rigged, with loose-footed sprit mainsail, stay foresail, jib and jib-headed topsail set on a long pole. The main sheet works

FIG. 108.—Cattegat fishing boat.

on an iron traveler extending across the stern of the boat, but, according to the model exhibited (fig. 108), the sheet is abaft the end of the tiller and the latter must be tilted or unshipped when tacking—a rather unhandy arrangement. The mast is supported by two shrouds on a side and by a stay setting up to the inside of stem. It stands more than two-fifths of the boat's length from the stem.

Following are the relative dimensions of a boat of this type: Length over all, 31 feet 3 inches; beam, 12 feet 6 inches; depth, 4 feet; mast, above deck, 22 feet 6 inches; topsail pole, 27 feet 6 inches; bowsprit, outboard, 6 feet 8 inches.

Lynæs herring boat.—The drift-net herring fishery prosecuted in the fall from the island of Zealand is very important. Heavily built decked boats, from 6 to 7 tons, are employed in this industry. Sometimes the rig consists of a sprit-mainsail, topsail, staysail, and jib, "otherwise the type is similar to the well-known Swedish deck boats. Experience has shown them to be exceptionally well adapted for fishing with drift-nets in the Cattegat, as they are both good sea boats and not too heavy, to drift with implements used by our own fishermen for such fishing. The boats are built without tanks, but with a large hold, where the nets with the catch are placed when hauled."

One of these decked boats from Lynæs is very wide, with flaring ends; convex lines; hollow floor; raking, curved stem and sternpost; square-heeled rudder, and symmetrical sheer. It is rigged like the Norwegian pilot boat; the pole mast is more than two-fifths the boat's length from the stem, and it has a long bowsprit. It carries a high, narrow-footed boom and gaff mainsail, club-headed topsail, jib and staysail.

This boat is 32 feet 6 inches long, 13 feet 8 inches beam, and 4 feet 6 inches deep.

Hornback fishing boat.—Drechsel figures a decked boat from Hornback similar in form and rig to that last described, from which it differs chiefly in having hollow lines forward and aft, and in having less width proportionally, and less flare to the sides. It is 36 feet long, 13 feet 8 inches wide, and 5 feet deep.

This is one of the several types of boats he mentions as being employed in the deep-sea fishing. "This fishery," he says, "has from olden times been one of the most important of the Danish home fisheries, and so it is still. Up to ten years ago it was exclusively a home fishery, and only small open boats were used by the fishermen for setting their nets near home and drawing them daily, weather permitting. This is still done in many places. Since 1878 this fishery has, however, been developed to a deep-sea fishery, with decked boats, especially in the Kattegat, and in summer along the west coast of Jutland. These boats stay out at sea for a number of days at a time, and visit the banks where fish are more plentiful."

Limfiorden fishing boats.—An open, sharp-sterned, clinker-built keel boat (fig. 109) is used in the fisheries from Limfiorden. It has hollow floor and water lines; curved stem and sternpost, the latter having a very strong rake; round-footed rudder, and moderate sheer. It has a short half deck forward, flush with the gunwales, and washboards along the sides. It is fitted with 3 thwarts, and has a well in the center one-third as long as the boat, for keeping living fish.

It is sloop rigged, with a loose-footed, high-clewed sprit-mainsail, laced to the mast; jib set on stay to stem head, and jib-headed topsail set on the customary long pole.

Following are the dimensions: Length over all, 21 feet; beam, 6 feet 6 inches; depth, 2 feet 3 inches; mast above gunwale, 15 feet; topsail pole, 18 feet; width of mainsail, 9 feet 3 inches; oars, 16 feet 6 inches.

Cod-fishing boats.—According to Drechsel, an oddly shaped round-ended decked cutter is used in the cod fishery from Esbjerd. In general appearance it resembles some of the double-ended skiote of Norway, but is not so well designed. It is wide and deep, has strongly convex lines,

FIG. 109.—Limfiorden fishing boat.

excessively hollow floor, and flaring sides. The stem rakes strongly, and has a concave curve to near its top, where it bends abruptly, so that it tumbles in above. The sternpost is straight and raking below, but also tumbles in at top. It is loftily rigged, and carries a large boom and gaff-mainsail, stay foresail, jib, and club-headed gaff-topsail.

One of these cutters, designed by Th. Dahl, was 37 feet 9 inches long, 13 feet 9 inches beam, and 6 feet 9 inches deep.

A double-ended open boat is used in the cod fishery from the west

coast of Denmark. One of these boats designed by Dahl has an excessive flare forward and aft, being very full on gunwale line at bow and stern and much sharper below. It has straight, raking stem and sternpost; low, round floor; flaring sides, and graceful sheer. It is sloop rigged, with loose-footed sprit-mainsail and jib tacking to stem head. Mast stands only a little forward of amidships.

This design was for a boat 26 feet 6 inches long, 8 feet 4 inches wide, and 2 feet 10 inches deep.

Praams also engage in the cod fishery, with trawl lines, and seem to be much in favor. They often go 20 miles from home. Those about

FIG. 110.—Fishing praam.

16 feet in length have 2 men in a crew, but some of the larger ones carry as many as 4 men. A full-size boat of this type from Hirshals was exhibited, and also a model.

The Danish fishing praam (fig. 110) is a clinker-built keel boat. It has a long, flaring, overhanging bow, with a narrow V-shaped square end; straight, raking stem, with deep fore foot; round, rising floor; flaring sides; deep skag aft; square stern, outside of which is a straight, raking sternpost and square-heeled wide rudder. It is half-decked forward and aft, with washboards along the sides, the open space being oval shaped and about two-thirds the boat's length.

It is sloop rigged, and carries a loose-footed sprit-mainsail laced to the mast, and jib set flying from stem head. In light winds a jib-headed topsail is set on a pole, the sheet reeving through the upper end of the sprit, and another jib is sometimes set on an adjustable bowsprit.

The full-size praam had the following dimensions: Length, 16 feet; beam, 5 feet 8 inches; depth, 2 feet 2 inches; mast above gunwale, 13 feet 3 inches; mast from stem, 6 feet 4 inches; bowsprit, outboard, 5 feet 3 inches; topsail pole, 18 feet; oars, 12 feet 4 inches.

Sound fishing boat. – The large boats that fish in the sound between the Danish and Swedish coasts are similar in form, build, and rig to the Swedish boats from Skåne. So strong is the resemblance that it is apparent that both have a common origin, and any slight differences are due to individual ideas of builders.

The Danish boats from Snekkersteen vary from 16 to 24 (Danish) feet in length, and from 4 feet 6 inches to 8 feet beam. They are sharp-ended, clinker-built keel boats. The smaller ones are open, but they are practically the same in form, build, and rig as the larger decked craft.

One of them has the following features: It is wide and remarkably deep, with sharp ends; slightly hollow, high floor; very deep keel, and raking, curved stem and sternpost. The rudder is, of course, hung outside. The lower pintle is of great length, coming up to the water line, so that the rudder may be easily hung when the boat is afloat. It is clinker-built, with nine strakes of plank on a side. The outside plank and frames are of oak, the deck of soft wood. It is decked, with the exception of a small, oval-shaped cockpit, for the helmsman at the stern, and another semicircular cockpit aft of the cabin entrance. Both cockpits are moderately deep, and have seats around them; a ladder with two steps leads from the larger one to the deck. The deck is flush with the gunwales, above which are very low rails provided with scuppers for the escape of water. The square "trunk" which forms the top of the cabin is about in the center of the deck. The cabin is large and comfortable, considering the size of the vessel. Forward of this is the hold, for the storage of fish, gear, etc., and the entrance to this is through a hatch forward of the mast. Between this hatch and the bow is a stout cavil, secured to two upright posts, and to this the heel of the bowsprit is fastened. There are bitt-heads aft for belaying ropes to.

These boats are usually provided with two long oars and with row-locks. In calm weather oars are often used.

They are cutter rigged; the single mast is supported by a stay to the stem head and a shroud on each side. They carry a running bowsprit; the long gaff-topsail pole serves the purpose of a topmast when light sails are set. There are four sails on a first-class boat of this type, namely; jib, stay foresail, mainsail, and jib-headed gaff-topsail.

The jib sets flying, the stay foresail laces to the stay and is provided with two reefs; its sheet trims and works upon an iron traveler that extends from side to side of the deck. It has a loose-footed gaff-mainsail which is laced to the mast; the head has a low peak which is characteristic of the rig of these boats; the lower sheet block works on a metal traveler. There are two reefs in the mainsail. The triangular gaff-topsail is bent to a long pole, the lower end of the pole reaching halfway from the masthead to the deck. The area of canvas is not large, and there need be little fear that these boats will capsize. They are well formed, both for speed and seaworthiness, and they are doubtless excellent sailers and very safe in a seaway. They fish in the Cattegat as well as in the sound. Each boat carries 2 to 3 men in a crew.

The following are the measurements of a Snekkersteen boat: Length over all, 25 feet; keel, 16 feet 3 inches; beam, 9 feet; depth of hold, 4 feet 4½ inches; draft of water, aft, 4 feet 5 inches, forward, 4 feet 2 inches; depth of keel, 1 foot 3 inches; least free board, 1 foot 10½ inches; length of rudder, 8 feet 6½ inches; average width of rudder below water line, 1 foot 10½ inches; length of tiller, 2½ feet; house, 5 by 5 feet; height of house above deck, 11 inches; oars, 15 feet long; boat hook, 10 feet long; mainmast, above deck, 19 feet 6 inches; main gaff, 10 feet 10 inches (this has a peculiar metal jaw—a metal ring that slides on the mast is jointed, on its after side, to a flat piece of metal that extends forward from the gaff end; this flat piece runs back into the end of the gaff, which is riveted to it); gaff-topsail pole, 21 feet 3 inches; bowsprit, total length, 13 feet; outside of stem, 9 feet 2 inches; sails—jib, luff, 20 feet 10 inches; foot, 11 feet 2 inches; leech, 13 feet; stay foresail, luff, 18 feet 9 inches; leech, 14 feet 7 inches; foot, 9 feet; mainsail, luff, 14 feet 2 inches; leech, 18 feet; head, 10 feet 10 inches; foot, 12 feet; gaff-topsail, luff, 15 feet 10 inches; foot, 10 feet; leech, 10 feet 10 inches.

Jutland fishing boat.—This type of boat is entirely open and clinker-built, with 9 strakes on a side, 9 frames, 2 breasthooks, one at each end, and 6 thwarts. The frame, gunwales, keel, and planking are oak, as are also the stem, sternpost, rudder, tiller, and oars. It is sharp aft, the stem and sternpost curve very slightly, but have a great rake, joining the rather light keel at an obtuse angle. The floor is hollow and the under water lines are slightly concaved, while, higher up, both the bow and stern flare considerably, the upper lines being strongly convex and much fuller than below.

It is sloop rigged, carrying a loose-footed sprit-mainsail and jib, the stay of the latter setting up to the stem head. The jib has two reefs and the mainsail three. Boats of this class carry four oars, which are made with the upper half of their looms square.

The following measurements are based on a model: Length over all, 19 feet 2 inches; beam, 6 feet 5 inches; depth, 2 feet 5 inches; mast

above thwart, 16 feet $9\frac{3}{5}$ inches; mast from stem, 6 feet $2\frac{1}{2}$ inches; oars, 16 feet.

Faroe Island fishing boat.—The Faroe Island fishing boats are mostly of one type, but they vary in size from about 23 to nearly 30 feet in length. Three sizes were exhibited at Bergen, ranging in length from 23 feet to 27 feet 2 inches.

The Faroe boat (fig. 111) is used in the various fisheries carried on at the islands. It is notably well formed for speed and seaworthiness, and aside from being somewhat wider in proportion, closely approximates the American whaleboat in form.

It is a sharp-ended, clinker-built, keel boat, with curved, strongly-raking stem and sternpost; rising floor; moderately flaring sides, and a peculiar shaped rudder extending below keel. It has a fine sheer, and is entirely open. Boats of this class are employed in the waters

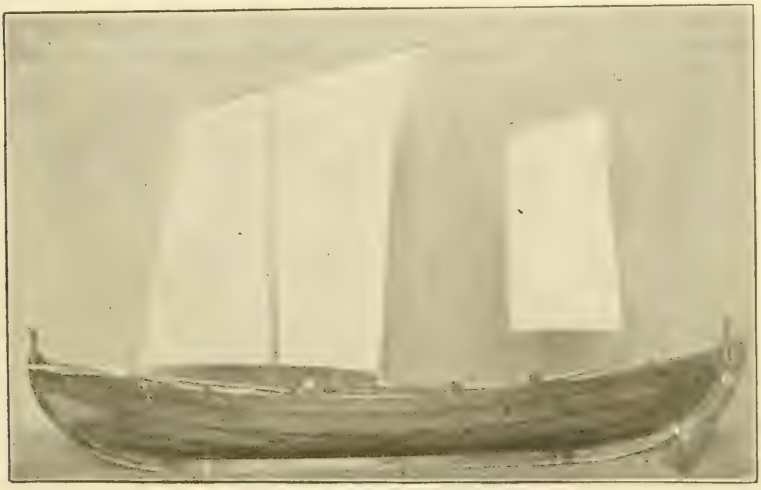


FIG. 111.—Faroe Island fishing boat.

of the Shetland and Orkney Islands, as well as about the Faroe Islands, in capturing the grind whale (*Delphinus deductor* of Scoresby), and the ca'in whale of Shetland and the Orkneys.

These boats are interesting, as representing a type which has probably been used for centuries in northern Europe.

The rig consists sometimes of a small lugsail, with the mast nearly amidship, but the larger boats often have a small lug-foresail and a sprit-mainsail. The foremast can be stepped either in the forward thwart or the one next abaft of it. It is usually, however, put in the former, so it is stated, and when thus placed it is claimed that the boat "will look pretty nearly dead in the wind's eye."

The whaling apparatus for one of these boats consists of two lances, two hooks and lines for towing dead whales, and a kind of large sinker fastened to a long line and used for the double purpose of anchoring

or deadening the boat's way, and as a missle for driving whales into shallow water.

One of these boats, the largest exhibited at Bergen, had 15 frames, spaced 21 inches from center to center, and 2 half frames. A curious feature of the construction is that the narrow garboards have only a little flare, in consequence of which they form a sort of well or channel, inside above the keel, for water, which can thus run freely from forward aft, without being obstructed by nets or fish.

It was fitted to row four pairs of oars, and had four thwarts; also a small seat at extreme stern for helmsman, and a similar one at the bow. It carried a lug-foresail and small sprit-mainsail. It was fitted with harpoon and killing lance, or knife, on handle. A thimble-shaped piece of iron is fitted over the flue of the toggle iron so that it holds the flue until the iron enters a whale, when it slips off.

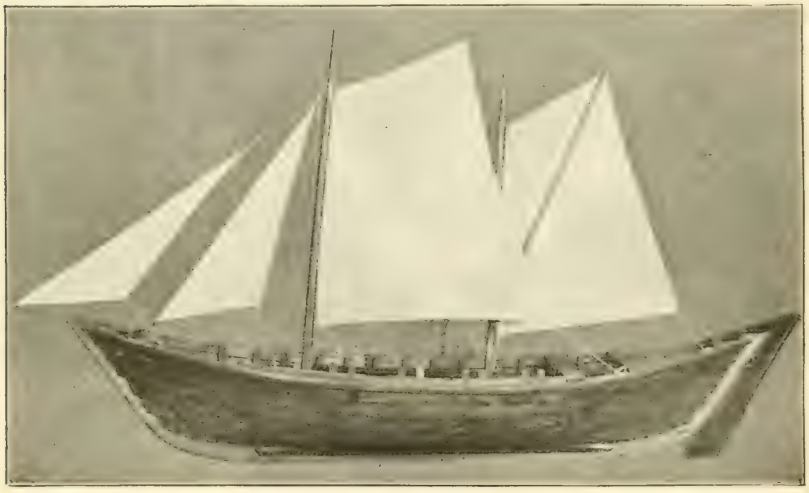


FIG. 112.—Iceland fishing boat.

Following are the principal dimensions: Length over all, 27 feet 2 inches; width, 7 feet; depth, 25 inches; foremast, above gunwale, 15 feet; foreyard, 10 feet 9 inches; mainmast, above gunwale, 11 feet 5 inches; oars, 10 feet 9 inches; harpoon, 13 feet 6 inches; spear or lance, 9 feet 9 inches.

Iceland fishing boats.—A considerable fleet of small craft is used in the fisheries of Iceland. These are generally open boats and are of small size.

None of the Iceland fishermen have a suitable harbor, according to Garde, but they are obliged to pull their boats on shore, and often the breakers prevent them from going out to sea. It should also be held in mind that the winter fisheries of the Icelanders are carried on during a season when there are only a few hours' daylight every day. The fishermen must go out to sea early, so that they can get to work when the short day breaks; and many a time they are out at sea fishing by the

weak light of the aurora borealis. The same causes which compel the west Jutland fishermen to use open boats are often met with in Iceland; but there is this difference, that the Icelanders can find many places where their vessels could lie sheltered if they possessed such vessels. The Iceland fishermen are generally too poor to get anything but open boats, and for this reason many a good day's fishing on the open sea is lost to them, and the number of their fishing days is greatly diminished thereby. Much time is also lost in rowing out to the fishing place and by the poor fishermen getting wet and hungry. The lot of the Iceland fisherman is a hard one. They take out little or no provisions, and it often happens that they have to go without food for more than twelve hours.[1]

A Danish writer who studied the fisheries of Iceland with much care a few years ago, makes the following statements concerning the boats used there:

It is difficult to give a form or type of boat which is in general use throughout the island. Even in localities which are adjacent, the form of the boat varies considerably, according to the local requirements. Thus the boats used on the south coast in the Faxe Bay, the Brede Bay, and the western fjords, resemble each other in some respects and differ in others. Each of these localities has some peculiarity as regards the build of the boat. In the Northland and Eastland the forms of the boats vary still more, as the fisheries in these parts have been developed only recently, and as especially on the east coast the fisheries are carried on by foreigners or by persons from other parts of Iceland, or from the Faröe Islands, all of whom, of course, use the kind of boat to which they have been accustomed from time immemorial.

As a general rule the Iceland fishing boats are arranged in such a manner that they can be used both as sailboats and rowboats, as occasion demands. The form of the boat is also adapted to the part of the sea where it is to be used, to the landing place, etc. On the south coast of Iceland, and in some other places where the fisheries are carried on in the open sea and where there is rarely more than one landing place, the boats are mostly rowboats. In the Faxe Bay the boats were formerly chiefly used as rowboats; but at present they seem to be in a transition stage toward sailboats, with heavy ballast, because the boats are somewhat narrower, for which reason they can also, if necessary, be used as rowboats.

In most places in Iceland it will be necessary to have a boat which is adapted both to sailing and rowing, as much as is possible, and which is suited to the sea and the landing places where it is to be used. A boat which is arranged either exclusively for sailing or exclusively for rowing, even if absolutely perfect in either respect, will not prove so useful to the fishermen as a boat which combines both qualities. Wherever sails are introduced care should be taken to adapt them both to stormy and calm weather. In Iceland there are no harbors for boats and they must in nearly all cases be drawn ashore. On the south of Iceland only a mainsail is used, as a general rule. In the Faxe Bay a jib is also used, with two masts with staysails. In the western part of Iceland only a mainsail was used some years ago, but recently many fishermen have begun to use jibs. It is safe to assume that about two-thirds of all the Iceland fishing boats have jibs.

Along the entire south coast only large boats with a crew of from 8 to 12 men each are used during the fishing season. In the Faxe Bay, the Brede Bay, and the

[1] The Fisheries of Iceland, by Aug. Garde.

western fjords besides the above-mentioned boats there are also employed smaller boats with a crew of 6 to 7 men each, but this is only done in exceptional cases when the fish come close to the coast. For the summer fisheries small boats with crews of 3 to 6 men each are used almost exclusively. During the fishing season the codfish have often to be caught at a considerable distance from the coast, sometimes as far as 2 to 3 Danish miles (9 to 14 English miles) and even further as in the southern part of the Faxe Bay, where, during the summer, I have seen the fishermen go out as far as 4 Danish miles (about 19 English miles); but of course when the fish are near the coast no one will think of going out any farther than is absolutely necessary.[1]

Among the models of Icelandic fishing craft exhibited by Denmark was one of a crudely constructed sharp-ended, clinker-built, open keel boat (fig. 112). It had a sharp floor, flaring sides, and raking stem and sternpost, both of which were straight except where they curved

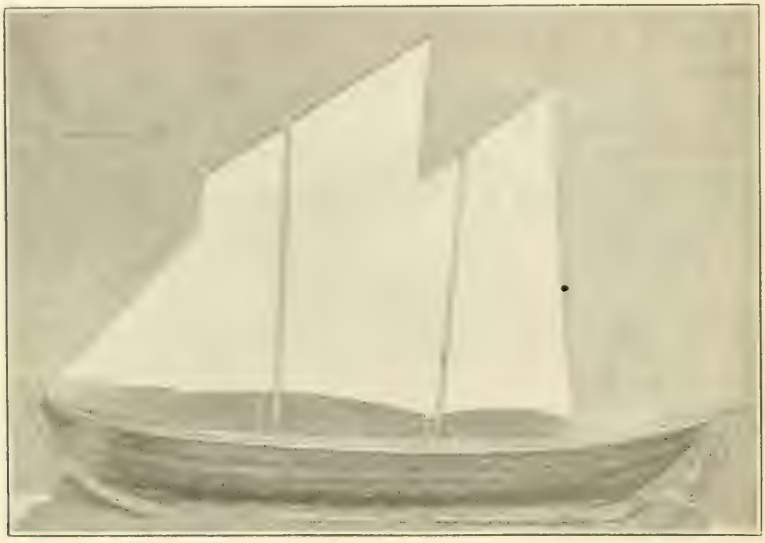


FIG. 113.—Iceland fishing lugger.

to join the keel. It had a good sheer and a narrow but heavy square-heeled rudder.

Above the central part of each gunwale was a heavy continuous rowlock, in which were four pairs of flat thole pins.

It was rigged as a schooner, with two loose-footed sprit-sails and two small jibs—both set flying—the inner one tacking a foot or two inside the stem head and the other to the end of a very short bowsprit.

Its dimensions were as follows: Length over all, 31 feet 4 inches; beam, 10 feet; depth, 3 feet 4 inches; foremast above gunwale, 14 feet 8 inches; mainmast, 13 feet; bowsprit, outboard, 2 feet 6 inches; oars, 12 feet 8 inches.

Another Iceland boat (fig. 113) was also sharp ended and clinker

[1] "Hr. Annaniassons Rejseberlting fra island;" in Fiskerilidende, Copenhagen, December 23 and 30, 1884, and January 6, 1885.

built, with rather deep keel and strongly raking stem and sternpost. It had a rising floor nearly vertical garboards—flaring sides, square-footed rudder, thole pins in continuous rowlock piece on top of gunwale for two-thirds of boat's length. It had 18 frames, 4 thwarts, and 3 pair of oars.

It had a dipping-lug foresail, a loose-footed standing-lug mainsail, and small jib, tacking to stem head.

The relative dimensions were as follows: Length over all, 35 feet 9 inches; beam, 9 feet 1 inch; depth, 3 feet 1 inch; foremast, above gunwale, 18 feet; foreyard, 16 feet 8 inches; mainmast, above gunwale, 17 feet 1 inch; yard, 10 feet 6 inches.

Greenland kaiak. A full-size, sharp-ended, skin-covered kaiak (fig. 114) was exhibited in the Danish section. As is well known, these graceful, buoyant, and exceedingly useful boats are constructed by the Eskimo, who exhibit the utmost skill and daring in the management of kaiaks, which, to the natives of the far north, are what the horse is to the Arab. Seated in his little boat, with his waterproof coat tied tightly around the rim of the single manhole, and the kaiak thus protected from the possibility of taking in any water, even though

FIG. 114.—Greenland kaiak. (Drawn by C. B. Hudson.)

seas sweep continuously over it, the Eskimo will perform marvelous feats, even as a matter of sport, rolling himself and his boat over and over in the water by a dexterous use of the paddle.

The kaiak is made of seal skins, sewed together with sinews, and drawn tightly over a light framework, usually made of driftwood, or a combination of wood and bone, all of which is tied together with sinews or strips of hide. It is usually 14 to 17 feet long and only wide and deep enough to admit of a man sitting in it by shoving his legs forward under the skin-covered deck. It is propelled by a double-bladed paddle, and is usually equipped with bird spears, harpoon or lances, according to the particular objects of pursuit.

Apparatus of capture, etc.—The apparatus used in the capture and preparation of fishery products by Denmark and her dependencies was well represented by numerous objects. It was noticeable, however, that, as with Sweden, various forms of nets predominated in the exhibit from Denmark itself, indicating the fact that most of the fish taken are captured by such devices.

Faroe whaling implements.—The harpoon used by the Faroese for killing whales is a form of "toggle iron," with a handle 6 to 10 feet

long. The lance is different from anything I have seen elsewhere. It is a round-pointed, double-edged, knife-shaped blade, 12 or 15 inches long, and is 2 to 3 inches wide; it is fixed into the end of a long wooden handle, around the lower end of which, where the haft of the blade enters, is wound a stout seizing to keep it from splitting. Iron hooks are used for towing whales; these are hooked into the dead animals, and the towrope attached is fastened to a boat's stern. An iron implement is used for splashing in the water to frighten whales when the latter are being driven ashore in bays, as is sometimes the case.

Nets and seines.—The Copenhagen Net and Twine Manufacturing Company exhibited various kinds of nets, traps, and pots, and illustrations of the same.[1]

The gill nets used for herring fishing are similar in construction and rig to those of the fishermen of southern Sweden, who fish in the same

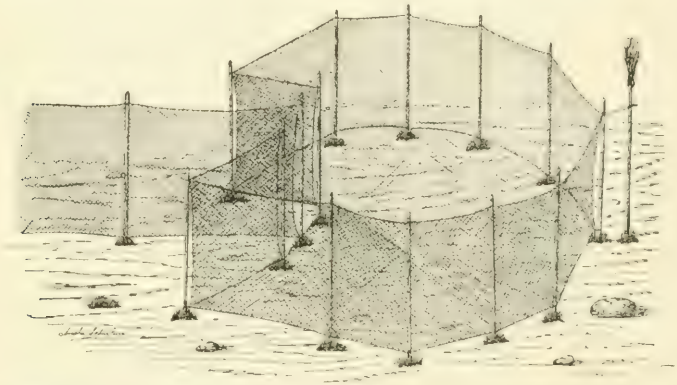


FIG. 115.—Single-bowl pound net. (Exhibit of Copenhagen Net and Twine Manufacturing Company.)

waters. As a rule, wooden or cork floats and stone sinkers are used on the gill nets.

Ordinarily the floats are attached to the headrope of a net, but sometimes to another rope which floats at the surface and supports the nets by means of short ropes placed at intervals and reaching from the cork rope to the headrope of the net several feet below the surface.

The drift nets used in the North Sea have the floats along the upper margin of the net, which may be sunk several fathoms deep.

The "net swing," by which the boat or vessel is held to the nets, is sometimes bent to the corners of each net of the "drift" or "gang," and in other cases it is held to the nets by short ropes at each corner and from the middle of the net, and stretches along for the entire length of the whole number. In either case the nets are supported by buoys attached by ropes to each corner, the length of these ropes

[1] Many of the illustrations of Danish pound nets, trawl nets, fykes, pots, etc., in this report are from the drawings exhibited by this firm.

being adjusted to the depth at which it is desired to have the upper edge of the nets below the surface.

Some of the gill-net sinkers are similar to those of Sweden. One of these was a stone incased in tarred canvas and lashed to the foot-line of the net with seizings of twine. This sinker was $2\frac{3}{4}$ inches long, and the canvas at each end extended beyond the stone from 2 to $2\frac{1}{2}$

FIG. 116.—Plan of double-pound net. (After Drechsel.)

inches. The floats on the same net were flat corks $\frac{5}{8}$ inch thick, $2\frac{1}{2}$ inches long, and $1\frac{1}{2}$ inches wide.

In another instance small smooth pebbles were incased in cotton cloth and held to the foot line as above described. A tubular-shaped lead sinker $\frac{5}{8}$ inch long and $\frac{3}{4}$ inch diameter is used on flounder nets, a number of these being strung on the foot line.

According to Drechsel the seines used in Bornholm waters are made of hemp and are from 20 to $22\frac{1}{2}$ fathoms long and from $2\frac{1}{2}$ to 3 fathoms deep.

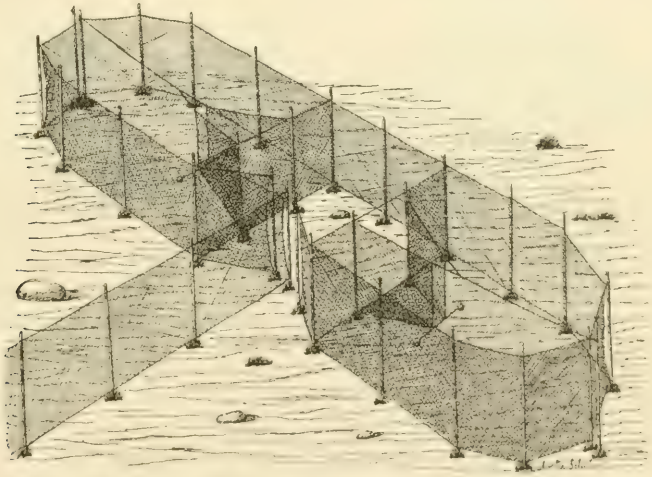


FIG. 117.—Double pound net. (Exhibit of Copenhagen Net and Twine Manufacturing Company.)

Pound nets are, apparently, in common use in Denmark. These are of various forms. The simplest is shown in figure 115. This is only a leader with a circular-shaped pound at its end. Figure 116 is a diagram of the widely used double-pound net, set tandem. The equally well-known double-heart fishing trap is made in Denmark. Each of these has a funnel-shaped entrance to the pound, the sides of which are dis-

tended or held apart by guy lines fasted to a bar at the bottom, while the upper corners of the funnel are held in position by a bridle, into which is bent a rope from the "head stake" at the back of the pound. Drechsel figures pound nets with one and two square funnels like those used on the Great Lakes or by the Pacific coast fishermen, and one such was shown by the Copenhagen company, although the entrances of all the others represented by the firm, were open at the top, or at top and bottom, as is common in our Atlantic coast pound nets.

The double pound net, with a bowl or pound on each side of the head of the leader (fig. 117), is quite different from ordinary forms of this kind of net.

The single bowl pound net, without heart, is often set tandem, one after another at regular intervals on a long leader. Sometimes, however, one of these is placed at the extreme outer end of the leader, and inside of this, at regular intervals, other short leaders cross somewhat diagonally, having a pound at each end (fig. 118). Thus a considerable number of pound nets are connected with one long leader

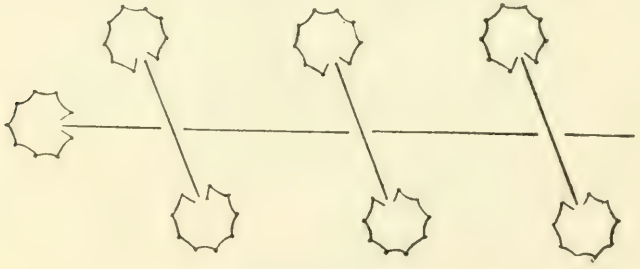


FIG. 118.—Plan of multiplex pound net. (After Drechsel.)

extending outward from the shore, constituting together a most effective and killing arrangement of fixed netting. The ordinary method of setting pound nets is similar to that in vogue in almost all countries where this device is used.

Otter trawl.—The otter trawl is a favorite form of apparatus in Denmark for catching various species of bottom-feeding fishes, especially flatfish. It is common for these to be used of a size that makes it practicable for them to be towed by a boat.

As is well known, the otter trawl consists of a bag-shaped net with long wings, the latter being provided at their ends with square or oblong pieces of plank, called "otters," which are so hung by bridles to the towing line that, when towed over the bottom, they spread apart, thus causing the net and wings to cover a wide reach of ground. This is essential in order to catch ground fish to advantage.

A full-size otter trawl of the kind referred to was exhibited in the Danish section. This was provided with 12 glass floats on each wing and 5 on the upper side of main part of the trawl, these floats being 4

inches in diameter. Square stone sinkers were attached to the lower edge of the wings and ground rope.

The following are the dimensions of the net: Length of wings, each 26 feet; length of bag or main part of trawl, 20 feet; length of funnel leading into the end of the bag net, 16 feet; mesh, 1½ inches; otters, each 3 feet 1½ inches long by 2 feet 8 inches wide; length of each leg of wire bridle, 75 feet.

Eel and flounder trawl.—A simpler form of trawl, the so-called "snurrevaad" (fig. 119), is used for catching flounders and eels. It consists only of a net bag with two long arms like the otter trawl, but without funnel, and having stout round pieces of wood fastened across the ends instead of otters. There is a rope bridle to each of these end poles, to which is bent the hauling warps. The upper edge of the net is supported by cork or wooden floats, and lead sinkers are generally used to keep the ground line on the bottom.

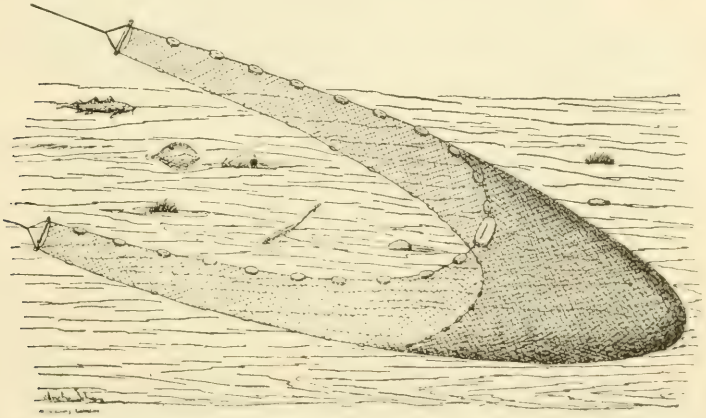


FIG. 119.—Flounder trawl. (Exhibit of Copenhagen Net and Twine Manufacturing Company.)

This is sometimes operated by two small boats, but also by one. In the latter case one of the wing lines is fastened to an anchored buoy and then run out until the net is reached—some distance from the buoy—when the latter is set and allowed to sink to the bottom. The fishermen then let out the other wing line, pulling their boat back so as to come abreast the buoy. At the proper time the boat is tied to the buoy and they haul away on both wing lines, dragging the net over the bottom and sweeping in any fish that may be in its course.

Another form of the snurrevaad has an inner funnel and the same shape as the otter trawl. A favorite method of operating this is shown in figure 120, taken from Drechsel's treatise. The net is set out from a large sailboat, which is hove to so that it will drive sideways to leeward, dragging the net slowly over the bottom. The wing lines are fastened, one to the outer end of the boat's bowsprit and the other to the stern outrigger; this arrangement keeps them far enough apart to

spread the wings of the net, the ends of which are kept close to the bottom by a heavy sinker—usually a stone—on the wing warp in front of the bridle.

Fykes, traps, etc.—Fykes or "hoop nets" are extensively used in Denmark for taking fish, eels, and other varieties of marine animals. Most of those used for fish are of the ordinary form with from two to eight hoops and two to three funnels; they are commonly set with a

FIG. 120.—Towing flounder trawl. (After Drechsel.)

leader and two wings, but of course there is much variation in placing them, this usually being due to local conditions. Sometimes, for instance, the wings are turned back at a sharp angle, thus forming a hook, or something like the heart-shaped entrance of a pound net, to prevent the escape of fish which may follow the leader to its end. Occasionally the outer entrance is square, though the other sections of the net are extended by hoops, and in one form of fyke, which has

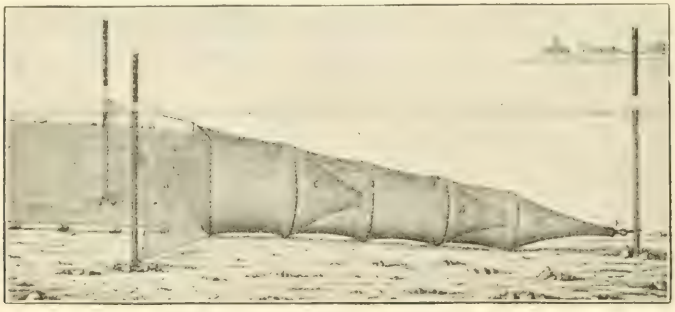


FIG. 121.—Prawn fyke. (After Drechsel.)

nine frames or hoops, the four next the wings are frames, composed of straight plank sill with a hole at each end, into which is put the end of a flexible pole that is bent over in a curve to meet the one on the opposite side until the upper ends cross, when they are fastened together in that position.

The prawn fyke (fig. 121) is of the conventional form and is set in the usual way.

The eel fykes of Denmark are like those of Sweden and need not be described in detail. They are often set side by side along the shores, with loops at the outer ends of the eelpots, slipped over an upright stake, so that the pots can easily be lifted by a fisherman in a boat (fig. 122). At other times, however, a wattle-work leader is built out from the shore so that it will intercept the progress of eels along the coast and direct them into the fyke, one wing of which is joined to the outer end of this bar or weir. A plank walk and a railing are erected above the leader, having at the outer end of the walk a platform upon which the fishermen can kneel to lift the eelpot, as shown in figure 123.

FIG. 122.—Lifting an eelpot. (After Drechsel.)

It is sometimes the case that a complete labyrinth of fykes extend outward from one of these wattle barriers, the leader of one fyke lapping by the head of another, so that it scarcely seems possible for eels or fish to escape capture when they have once entered the maze.

The "salmon yard" at Gudenaa, illustrated by Dreschel (fig. 124), is an effective device for catching salmon trout and salmon—chiefly the former—when they are ascending the river to spawn. It is set so as to constitute a barrier, and the fish passing on that side must necessarily be entrapped. The salmon are usually caught in a seine set inside the "yard."

Following is the explanation of the figure: *a*, *b*, *c*, *d*, arms of weir; *e*, head or pound; *f*, entrance to pound; *g*, "vestibule;" *i*, "prison yard;" *k*, closed tanks or storage pounds; *l*, sailing channel for boats; *m*, iron gate; *n*, gate for the prison yard; *o*, pillars for prison yard; *p*, ice pillars; *q*, bridges for foot passengers, etc.

FIG. 123.—Lifting an eelpot. (After Drechsel.)

Trawl lines.—Trawl lines are used for catching various species of fish, including eels and salmon. The lines for cod or other bottom fish differ in no essential particular from those of neighboring countries, but resemble those of Sweden more closely perhaps than any others.

A section of trawl line exhibited (fig. 2, Pl. XXXIV) had round-bowed hooks 2 inches long, on snoods 10 inches long and 3 feet 8 inches apart. It has a round lead sinker attached to a piece of line several fathoms long, which was bent to one end of the trawl. The hooks of this long line, and of Danish long lines generally, are held in a wooden device like those used in Sweden.

The peculiarity of the salmon trawl line is that it is set floating near the surface of the water.

Hand-line gear.—Various forms of hand lines and hand-line gear were exhibited by Denmark. Among these the following-described specimens were some of the most interesting:

Cod hand-line gear.—As a rule, the Danish cod fisheries are prosecuted where heavy sinkers are required. The largest of these are about the size of the "fishing leads" used on the Georges Bank by New England fishermen.

One form of cod gear used on the decked vessels that go to Iceland (fig. 125[1]) has an octagonal lead sinker 9½ inches long and 1½ inches average diameter, weight approximating 8 pounds. An iron-wire spreader 2 feet long passes through the lower end of the sinker so

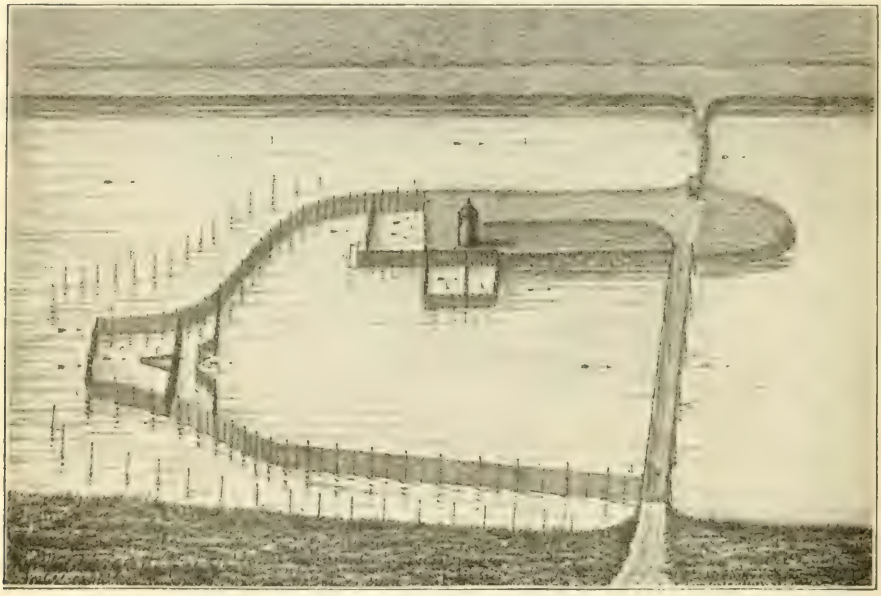


FIG. 124.—Salmon yard. (After Drechsel.)

that it projects half its length on each side. To each end of this is bent a snood 5 feet long, the lower end of which bends into the eye of the short ganging, holding a round-bowed galvanized hook 5½ inches long, with a fish-shaped piece of pewter cast on its shank.

Another kind of hand-line gear for cod exhibited is unmistakably of American origin, and, aside from the lead sinker, is a fair sample of the so-called "sling-ding gear" so extensively used by Gloucester fishermen on Georges Bank. The whole thing (fig. 125[2]), with the exception of some lead sinkers on the snoods and the big sinker heretofore referred to, was doubtless made by a Gloucester fisherman, and obtained by the Danes at the Iceland fishing grounds, where several of the Gloucester vessels make summer trips.

FISHING GEAR, ETC.

1. Shark line; 2, trawl line; 3, 4, fishermen's shoes; 5, 6, fish gaffs.

The sinker was made by winding sheet lead around an oak horse 17 inches long, having a swivel at its lower end. The lead was 7½ inches long and 1½ inches diameter. The hauling line was bent into a becket which was seized to the upper end of the horse. Sheet lead was wound on each snood about 18 inches above the hook to form a small sinker. Attached to the swivel at lower end of the horse was the well-known triangular sling-ding gear, line forming two sides of the triangle and the other being a steel wire spreader 21 inches long. At the lower end of each snood was a bone slot swivel of the American type for the

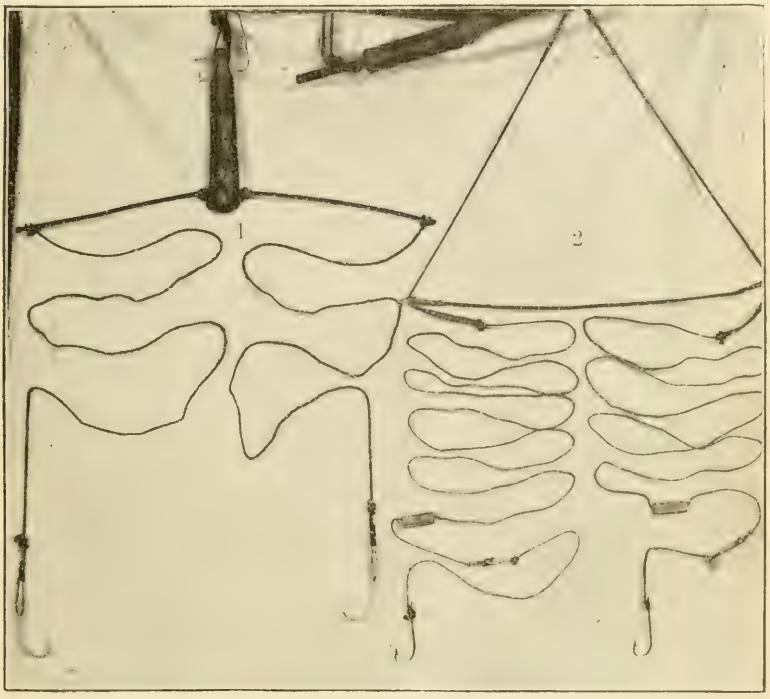


FIG. 125.—Cod hand line gear.

ganging to slip into. The entire length of snoods from hook to spreader (including gangings) was 9 feet.

A typical form of Faroe cod gear is shown in figure 126. The hemp line is wound on a reel something like those used in Norway. The line is bent to a lead sinker 5¾ inches long and 1½ inches diameter, having a curved wire spreader 2 feet long through it a little above the center. A line loop is fastened to each end of the spreader, and into this is bent a snood 4 feet long, having at its lower end a galvanized round-bowed hook 2½ inches long.

A large three-hooked jig (fig. 126) used for catching cod without bait was exhibited. This had lead in the shape of a fish cast on the

shanks of the hooks. This lead portion was about 8 inches long and weighed approximately 3 pounds. Two-hooked jigs are also used.

The hand-line gear used for catching the Greenland shark (*Scymnus microcephalus*) is shown in Plate XXXIV, figure 1. This consists of a loosely laid line about the size of nine-thread ratline stuff, bent to the upper ring of an iron sinker 13 inches long and about 3 inches in diameter. The hook is 11 inches long and 4 inches spread (from point to shank); it has a barb on the shank, a large swivel at its top, and is held to the sinker by a stout chain ganging 7 feet long. The swivel and the chain ganging are necessary, for the shark when hooked rolls itself over and over, and with its sharp teeth and rough skin would quickly sever a stout line.

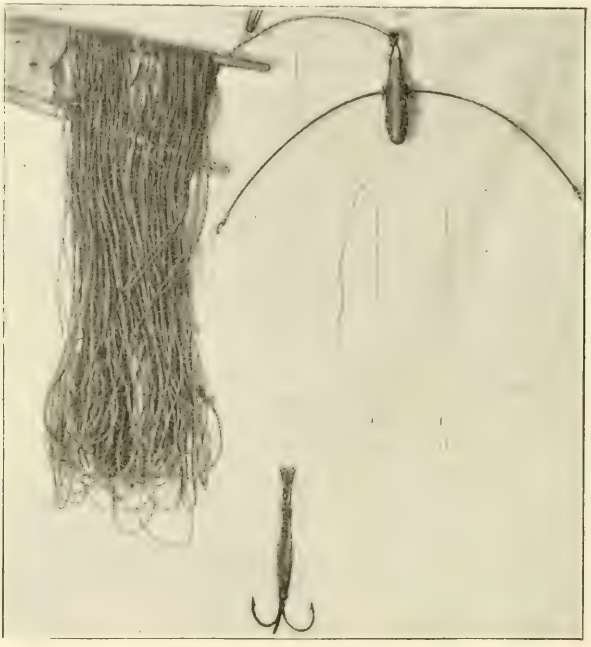
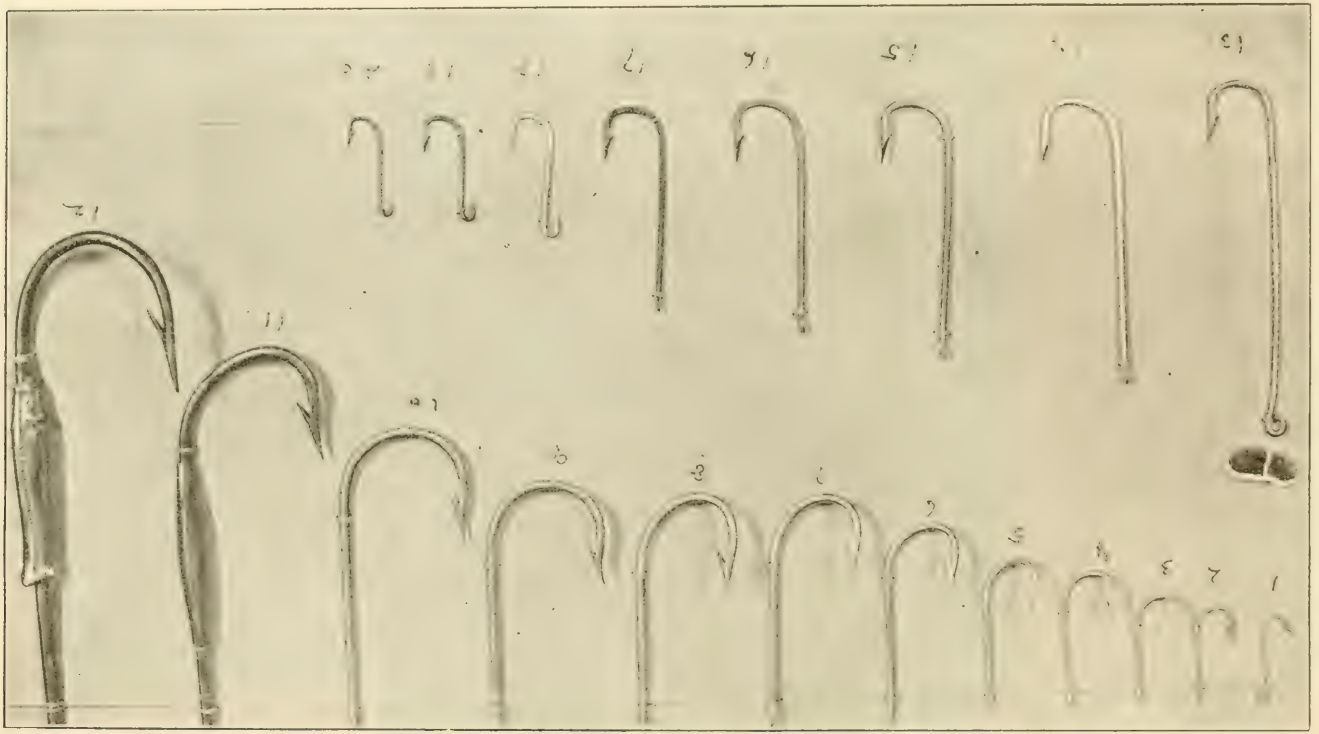


FIG. 126.—Faroe codfishing gear.

Hooks. The different kinds of hooks used in commercial fishing were exhibited by Conrad Christensen, of Copenhagen. As will be seen in Plate XXXV, they are all of the round-bowed type. Some are galvanized and some black. A few are Kirby bend, two have lead jigs on their shanks, a small percentage are eyed, but the majority have the tops of the shanks flattened, or are "flat eyed." The smallest hook of this lot, No. 1, remarkable for the angle of its point, is $1\frac{3}{8}$ inches long, and the largest, No. 12, $8\frac{1}{4}$ inches long.

Spears and gaffs.—The various conventional forms of eel spears and an eel hook, as well as the method of using them, are shown in figure 127, after Drechsel. These are similar to such forms of apparatus



FISH HOOKS.

used in Norway and Sweden, hence they were not specifically referred to there. They are all such well-known forms that detailed description seems unnecessary.

A peculiar form of eel spear was exhibited by G. Wittig. This is so constructed that it is adjustable to a considerable degree, and after a thrust has been made and an eel is impaled the escape of the animal is made impossible by a turn of the handle of the device, which locks it and holds the victim by additional points.

Figure 128 shows the spear unlocked. There is a small catch, which passes through the spearhead and operates the locking attachment. This is so arranged that it can be moved by a twist of the spear handle,

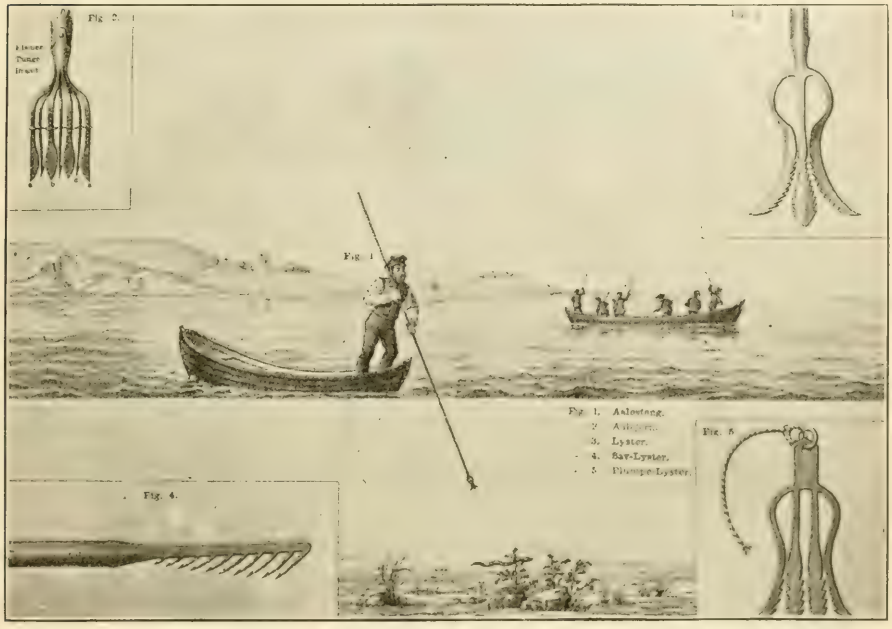


FIG. 127.—Eel spears and eel fishing. (After Drechsel.)

when the spear becomes locked, as shown in figure 129. The total width of this spearhead is $12\frac{1}{2}$ inches, and its height (of the head alone) is $3\frac{5}{16}$ inches.

Another form of adjustable spearhead is shown in figure 130. This was exhibited by F. Svendsen. It consists of an arrangement of springs, which control the action of the pointed spear prongs, that, in themselves, are quite of the ordinary form. The adjustment admits of some flexibility of the spear points, as already indicated, and when they pass over an eel they will open slightly to receive the body of the fish, but at the same time retain such a firm grip that he can not escape. This device is $15\frac{1}{2}$ inches high and 10 inches wide; the

outer prongs are 5⅝ inches long and central prongs 5 inches. The distance between the spear points is 5½ inches.

Two kinds of gaffs were exhibited (Pl. XXXIV). One of these (5), with a short handle and claw-shaped gaff nearly at right angles with the handle, is used as a gaff and killer in the cod and halibut fisheries. The other (6) has a long, round, soft-wood handle with a barbed hook, resembling in shape an ordinary fishhook, with the upper part of the shank flattened to fit to the handle.

FIG. 128.—Eel spear open. (Drawn by W. H. Abbott.)

Pots, etc.—The eel pots and lobster pots are similar to those of Sweden. A lobster pot is shown in figure 131. The Danish fishermen, however, use a hoop net for lobster fishing similar to that formerly employed by New England lobstermen (fig. 131). The ordinary lobster pot has three hoops, like that figured, one in the middle and one at each end, but the Copenhagen Net and Twine Company exhibited illustrations of larger forms, one with four hoops and one with five, having the same diameter, but much longer, and the longest one, at least, with greatly elongated entrances. The object in making these pots of extra length and changing the form of the cone-shaped entrances is seemingly for the purpose of making it easier for lobsters to get into the apparatus.

FIG. 129.—Eel spear closed.

FIG. 130.—Adjustable eel spear.

Live cars.—Floating or sunken live cars, made on the same principle as the lobster pots, but with projecting conical ends, are in favor in Denmark (fig. 132).

Eel dip net.—A peculiar kind of two-handled dip net is used for eel fishing in shallow water. The apparatus consists of a frame oblong on three sides and triangular at the ends. Two sides and the ends are covered, leaving an oblong entrance, across which are secured two poles which may vary in length from about 4 feet upward, the length depending on whether the apparatus is to be used from a boat or by a man who wades out into the water about waist high.

In either case the net is so placed that the lower side can rest on the bottom, along which it is shoved to catch eels that may be seen.

When wading is resorted to, it is usual for two men to work together. One of these manipulates the net, pushing it along with a hand on each pole, and towing after him by a string tied to his waist a tub to receive

the catch. This is covered with cloth to prevent the eels from escaping. The other man, armed with a pole, assists in driving the eels into the dip net. This device and the method of using it are shown in figure 133.

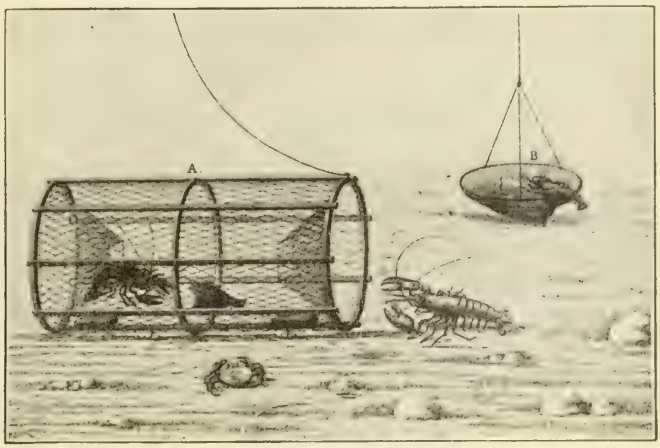


FIG. 131.—Lobster pot and hoop-net. (After Drechsel.)

Line rollers.—The line rollers used by the Danish fishermen more closely resemble those of New England than any I have seen in Europe. One of these had a three-scored wooden roller 11 inches long and 4½ inches in diameter arranged to revolve in an iron frame fitted to step into a hole in a boat's gunwale.

Killicks and grapnels.—Stone killicks or grapnels, similar to those of Norway and Sweden, are used in Denmark.

Buoys.—The buoys are often made of solid wood, but keg buoys are much in favor for net fishing. It is common for a buoy at the end of a gang of drift nets to have a lantern at the top of the pole that goes through the center of the keg (fig. 134), and this is kept upright by a weight at the bottom of the pole. Glass buoys or floats, similar to those of Norway, are sometimes used.

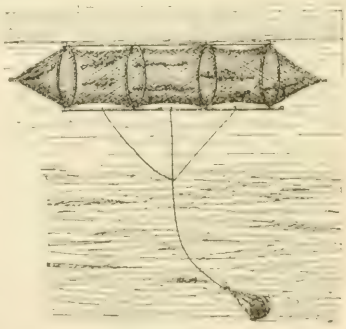


FIG. 132.—Floating live car.

Methods of fishing. Mention has been made incidentally of certain methods of fishery in the description of fishing apparatus, and these need not be repeated. Among the incidents of fishery none is more exciting or interesting than the capture of the grind whale (*Delphinus deductor*) when a large school of these cetaceans are found in a bay at Faroe.

When this occurs the fishermen gather in their boats and form a

cordon outside of the whales, which are harried and ultimately driven on shore by the noise and splashing made by the boatmen. An event

FIG. 133.—Eel fishing with dip net. (After Drechsel.)

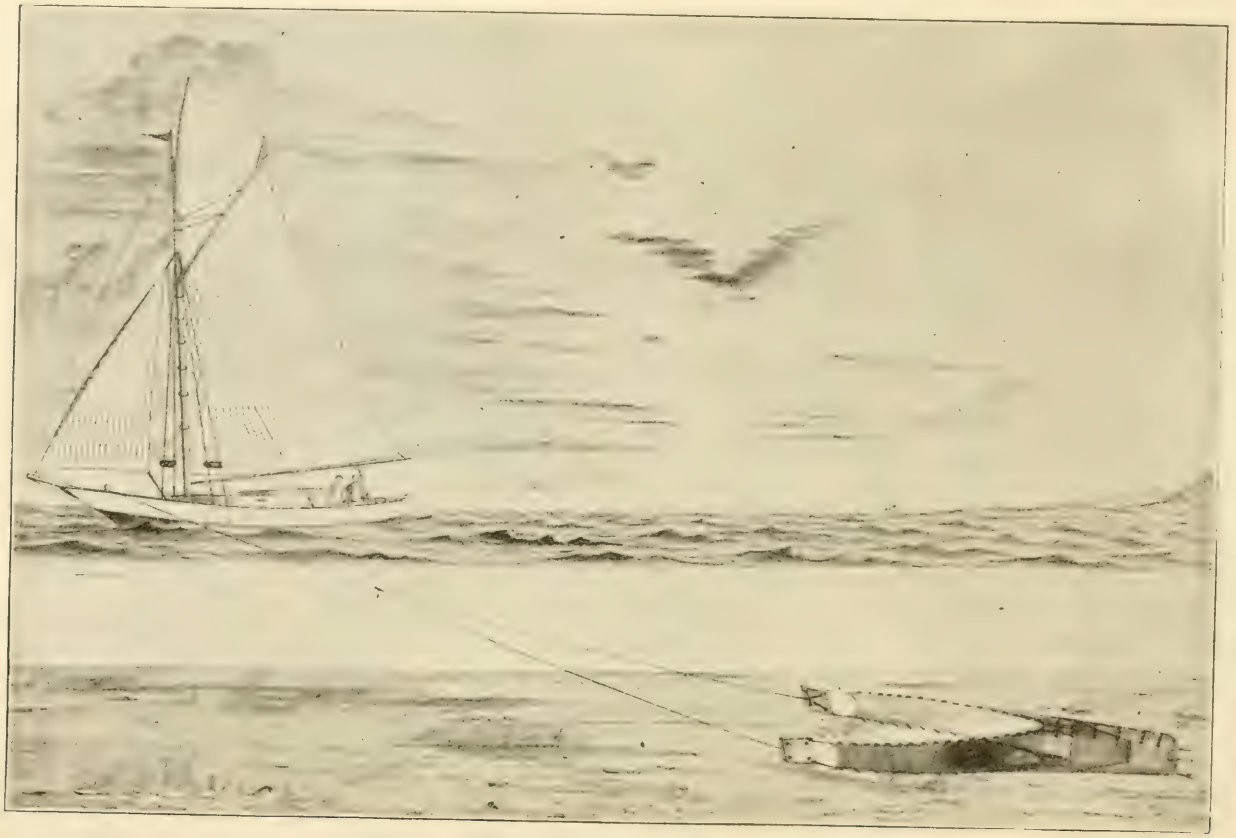
of this kind, which is similar to a blackfish drive at Cape Cod, was shown in illustrations exhibited in the Faroe collections (fig. 135).

The method of using an otter trawl in shallow water along the Danish coast is shown in Plate XXXVI. This is a reproduction of a pencil drawing that was exhibited.

FIG. 134.—Net buoy. (After Drechsel.)

A new method of operating a trawl line for the capture of eels was illustrated and described by Jens Pedersen. He asserts that when eel fishing with hooks baited with pieces of fish has been prosecuted for several years in a lake the eels get accustomed to this method of fishing and it is difficult to catch them, for they either do not go near the hooks or else take the bait off while avoiding capture. He declares that eels could not be caught at Tisso in 1890–91 in paying quantities on lines baited in the ordinary manner, while satisfactory catches were secured when the hooks were baited with small live fish. But shooting the lines from an ordinary line box with sand in it was such slow work that it was impracticable to use live fish, which died before the lines were out. He therefore designed a new kind of box, which, though simple, proved satisfactory. The method of fishing is as follows:

As the hooks are hauled in they are put into an ordinary low hook box;



TOWING AN OTTER TRAWL.

Drawing exhibited by Denmark.

the eels taken are allowed to retain the hooks they are on, the snoods being cut in two. These are replaced on shore; one man can arrange from 400 to 500 hooks per hour. When a box is filled a canvas cover is fastened over the hooks. So arranged, a line can be safely shot, without fear of entanglement, as fast as a boat can sail, thus making it possible to have the fish used for bait reach the bottom alive. In shooting the line, the line box is put on a thwart at the after end of the well, with the low side aft. The canvas is then removed and one man takes his position on a thwart far enough aft to reach the hook box. In a small tub of water between his knees are the little fishes for bait, the supply of which is renewed from time to time from the boat's well by the oarsman. With his left hand the fisherman takes a fish from the tub and with his right hand he picks a hook from the box. He quickly puts the hook into the back of the fish and throws it out with such force that the 8 feet of line between the hooks goes out, too, when the operation is repeated until the whole line is shot. In this manner 1,000 hooks can be baited and put into the water in an hour.

FIG. 135.—Driving whales at Faroe.

Fish products.—The klipfish from Iceland and Färöe, were of good quality, and were cured precisely like those of Norway and Sweden. There were exhibits of smoked eels, smoked herring, smoked sprat, anchovies, "rollmops," and various other canned products; also seal oil, brown cod-liver oil, seal skin, eider down and sea-fowl feathers. But none of these need be discussed in detail.

Fish culture.—A model of a trout-hatching station at Tissø, in which the circulation of water is supplied by a windmill pump, was exhibited by Jens Pedersen, of Tissø. The following explanation has been given by the exhibitor:

When water can be had from a lake high enough to circulate through pipes over a hatchery, it is, of course, most desirable, though not always obtainable. To overcome this so that artificial propagation can be conducted on a large scale, I worked out a design in 1886, which this model illustrates.

The pipe brings the water from a lake to the well, and is placed low enough to always be under water. The well is under the floor of the hatchery. The pumps, driven by windmills, take the water from the well to the tank. The windmill should be adjusted so that it requires no attention. If the windmill continues working after the tank is full the surplus water passes through a pipe to the well. The tank is thus always kept full of water as long as there is wind. The tank holds water enough to supply the hatchery for two days. If a calm should prevail longer the water must be supplied by a hand pump. The bottom of the tank declines a little

toward the faucet to facilitate washing away mud or silt which collects. The water passes through the faucet into the first section of the filtering apparatus, where some of the mud is deposited. It then runs over the partition to the next section, where it goes down through a zinc box filled with gravel. It then runs through the next partition and up through the next zinc box, and through a flannel screen. The water can thus be put into the hatching boxes free from impurities. These zinc boxes can easily be removed for the renewal of the gravel, and at the same time the sediment on the bottom of the tank can be washed out through the faucets on the back of the house.

There are eighty-four of these boxes in the hatchery referred to.

RUSSIA.

Commissioners.—The eminent fish culturist, Dr. Oscar Von Grimm, was the commissioner in chief from Russia. While Dr. Von Grimm is perhaps best known through his work as a fish culturist and scientific investigator, he has also written considerably on the practical aspects of the fisheries. His assistants were Charles Von Hulsen, secretary of the biological station at St. Petersburg, and A. Von Kuhne, an expert in exposition work.

General considerations.—The exhibit from Russia, which included instructive collections from Finland, was more extensive, comprehensive, and interesting than any similar display among the many I have seen from that country. It was particularly rich in illustrative material of commercial fisheries and fish culture, including collections of photographs, lithographs, and drawings, all of which were of great assistance in gaining a clearer and fuller knowledge of the use and purpose of the various other objects embraced in the collections.

The geographical location of the Russian Empire, and the consequent natural conditions that environ it, at present preclude the possibility of extensive sea fisheries. The Arctic Ocean, which is covered with ice most of the year and has only a brief summer, offers small inducements to the fishing industry, even if the coast bordering this inhospitable sea was not almost uninhabitable. The sea fisheries on the Asiatic side of the Empire appear not to have been developed, though it is possible that the completion of the Trans-Siberian Railroad may sometime lead to the exploitation of a fishery for cod and other species in the Okhotsk Sea and adjacent waters.

The fisheries of the Baltic and Black seas are of little importance. This is due in large part to their landlocked positions and the fact that the water in them is only brackish, having but a small percentage of salt, and therefore being neither adapted to fresh water species or those belonging to the ocean fauna.

It is probably the result of this condition that the fish of the Baltic are usually small, and authorities agree that both seas have a poor mixed fauna. The depth of the Black Sea is so great, even close up

to its shores, that the conditions are unfavorable for the sustenance of fish and other marine animals.

The conditions in the Sea of Azof, the Aral Sea and particularly in the Caspian Sea, differ materially from those of the Baltic and Black seas. While it is true that the former are all inland, or landlocked, bodies of water, which might properly be called salt-water lakes in some instances at least—they are peculiarly adapted to the sustenance of immense quantities of important species of food fishes, and also of seals, and consequently support rich commercial fisheries. Indeed, the fisheries prosecuted on these inland seas are so valuable that they are considered by Russians as ample "recŏmpense for the absence of rich sea fisheries," and may well be deemed "preeminent among the fisheries of the whole world."

The river systems of Russia are also exceptionally noteworthy for the amount of fish they yield. While this may apply with special force to the rivers emptying into the Caspian Sea and adjacent seas, it is also true of many streams flowing north and discharging their waters into the White Sea, or the Arctic Ocean. The possibilities of these inland waterways for sustaining fish life may be judged when it is stated that European Russia has 84 navigable rivers, some of them more than 3 miles wide, with an aggregate length of 19,870 miles. The Caspian Sea alone has an area of 8,413 square miles, and in "Fishing and Hunting in Russian Waters," Dr. Grimm gives the total area of inland seas and lakes, including the Caspian and the Sea of Azof, as 9,750.74 square miles. This summation does not include the Aral, nor many small lakes or ponds; the combined area of the latter being estimated at about 1,000 square miles.

It is not practicable here to enter into a detailed discussion of the commercial fishes of Russia, although the subject is a tempting one. It must suffice to make brief reference to the most important species, among which the sturgeon seems to be preeminent from a commercial standpoint. Five species of sturgeon, at least, are of importance. "The waters of Russia are very rich in these valuable fish," remarks Dr. Grimm, "with which no other fish can be compared as to the flavor, nourishing qualities, and the mass of useful products yielded by it."

The giant sturgeon (*Acipenser huso*) occupies a most conspicuous position, both because of its size and commercial importance. It occurs in the Black Sea and Caspian Sea basins, and is notably abundant in the latter. The average size of this species has been given at from 360 to 400 pounds, and specimens are sometimes taken that weigh from 800 to 1,200 pounds. It has been recorded that a sturgeon weighing 3,200 pounds was caught near Sarepta in 1813, one at Saratoff in 1829 of 2,760 pounds, and one on the Ural in 1847 of 1,600 pounds.

It is asserted that the minimum weight for the Astrakan market is 120 pounds.

Early in the eighties it was estimated that the total annual production of this species was 10,821,000 pounds. In 1897, however, the yield was much less, and aggregated only 6,136,446 pounds.

Considered alone from the standpoint of quantity taken, the sevruga (*A. stellatus*) is the most important of the sturgeons, for it has been estimated that the yearly output of this species exceeds 36,000,000 pounds.

The sevruga is found in the same waters with *A. huso*, but Dr. Grimm says it does not ascend the rivers very far, and is chiefly taken on the Ural and Kur. It is not proportionally so thick as the giant sturgeon, and weighs much less, 60 pounds being about the maximum, while 30 pounds is approximately the average weight of an Astrakhan sevruga. Dr. Oldekop reached the conclusion as the result of investigation that *A. stellatus* contains relatively a greater amount of nourishment than any other sturgeon, he having found 55.2 per cent of nourishing matter to a pound of fish.

The schyp (*A. schypa*) inhabits the same waters as the two foregoing species and is also found in the Aral Sea, where no other sturgeon is taken. It is rare in the Black Sea. It is caught in the Ural and Kur.

The sterlet (*A. ruthenus*) is one of the most important commercial species of the sturgeons. It is taken in the rivers emptying into the North Caspian and the Black seas, but is so rare in the rivers flowing into the south side of the Caspian—the Kur, for instance—that it is not an object of fishery there. It is also abundant in Siberian rivers that enter the Arctic Ocean. Dr. Grimm points out the fact that in the forties "the sterlet penetrated through the canals into the North Dwina, and finding the conditions favorable to its existence, it not only settled down and multiplied, but acquired some peculiarities in its exterior—a short, blunt snout and an arched back—and also a fine flavor, for which in St. Petersburg it is prized more than the Volga sterlet. I must remark that even in the system of the Volga the sterlet is much finer in the north—for instance, in the River Sheksna—than in the southern part, and the farther south one goes the less tasty the sterlet becomes."

The sterlet is notably a small species. It is said to attain a weight of 60 pounds, but such fish are exceedingly rare. The authority above quoted states that "the greater part of the sterlets caught and sold are generally from 30 to 50 centimeters long."

The so-called "eastern sturgeon" (*A. güldenstädtii*) occurs in the same waters where the sterlet is found, but not so far up the rivers, and farther to sea than the latter. It ranges all over the Caspian, and is found in the Persian rivers and the Kur. Its arctic range is greater

than the sterlet, for it is found farther north than the latter in the Siberian rivers.

While it attains a weight in Russia of 200 to 240 pounds, the average market weight does not exceed 60 pounds.

The western sturgeon (*A. sturio*) is an inhabitant of the Baltic Sea and the streams flowing into it. It is occasionally seen in the Black Sea, which it enters from the Mediterranean.

In addition to the above-mentioned sturgeon there is said to be two other species in the River Amur, also "three species of the genus *Scaphirhynchus* in the rivers Amoo-Daria and Sir-Daria, which fall into the Aral Sea; these are *Scaphirhynchus Fedtschenkoi*, *S. Kaufmanni*, and *S. Hermanni*, but these are of no consequence in the fish trade."[1]

The Caspian Sea herring (*Alosa caspica*) and the Black Sea herring (*A. pontica*) are among the most important commercial species of fish in European Russia. These are closely allied species, though distinguished by the fishermen, and are commonly sold together. The chief difference in appearance is in the size, the Caspian herring being much larger than the other. Both species are taken in large numbers in the Caspian and Black Sea regions. About 1850 herring taken at the mouth of the Volga were utilized only for the manufacture of oil, for the Russians believed this to be a "mad" fish; they called it "beshenka," and no one would eat it. A few years later herring began to be used as a salted product. About 10,000,000 were salted in 1855, and since that time the demand for it has increased, until enormous quantities are now cured annually.

A. caspica looks like a sea herring; it is about the size of a shad (*Alosa sapidissima*), but it is not so deep in proportion. The Black Sea herring is much smaller, but still larger than the sea herring. This is called "poozanook," and is reputed to have a better flavor than the larger Caspian herring.

The sea herring (*Clupea harengus*) is an important object of fishery in the White Sea. The herring taken in the Baltic are small, like the "strömming" of the east coast of Sweden, but are called "salaka" by the Finns. They are a variety of the sea herring.

There are two species of salmon—the *Salmo salar*, which is taken in the Baltic and in the White Sea region, and the Caspian Sea salmon (*S. caspius*, Kessl), "which is found in the southern and central parts of the Caspian, from where it goes up the rivers to spawn, chiefly ascending the rivers Terek and Koora." The latter species averages about 20 pounds in weight, and the yearly output has been estimated at 180,000 pounds, while the yield of the northern or Atlantic species is ten times that amount.

[1] Fishing and Hunting in Russian Waters, by Dr. O. Grimm, p. 26.

The salmon trout (*S. salvelinus*) is of some commercial importance in the north, and two other species of trout (*S. gegarkuni* and *S. ischchan*) are taken in Lake Gakteha, in the Caucasus. The so-called "white salmon" (*Luciotrutta leucichthys*) is one of the most valuable and highly prized food species of Russia, and it is asserted that none of the other coregoni can compare with it for delicacy and richness of flavor. It is taken in the Ural, in the Volga, and its tributaries. The nelma (*Coregonus nelma*) closely resembles the "white salmon," and is found in the north, occurring in the Petchora River, the North Dwina, and in Koobinskoë Lake.

"About 30,000 poods of white salmon a year are exported from Astrakhan," according to Dr. Grimm, "while the whole amount of white salmon caught, not only in Astrakhan, but also in the Ural, all along the Volga and Kama, etc., and of the nelma caught in the basin of the Arctic and the White Sea very likely reaches 100,000 poods" (3,600,000 pounds).

There are many varieties of white-fish in Russia besides those referred to. Polyakoff found thirty-five species, of which eight belong to the Baltic region. The largest of these (*C. muksun*) is a Siberian species which is celebrated for the richness of its flavor.

The smelt (*Osmerus eperlanus*) and a lake variety (*O. spirinchus*) are both inhabitants of the regions of the White Sea and Baltic, and the latter is found in some of the lakes of the Volga river system. It has been officially stated that more than 36,000,000 pounds of these two species are taken annually in the waters of northern Russia.

The yellow perch (*Perca fluviatilus*) occupies quite an important position in European Russia. It occurs in all the lakes and rivers, and is also found in the Baltic, the Sea of Azov, and the Caspian.

It is taken of all sizes, from less than 2 inches in length up to the maximum size. Its average weight is not exceeding 3 pounds, but specimens from the trans-Ural region have been recorded as weighing from 10 to 12 pounds—a most extraordinary size for this species. The catch of perch in the Astrakhan region in 1897 amounted to 3,662,860 fish.

The gremille (*Acerina cernua*) is found in all fresh waters except the rivers flowing into the southern Caspian. It is a small species, seldom exceeding one-fifth to one-third of a pound weight in European Russia, but Siberian specimens have been taken that weighed 1½ pounds, though such are rare. These little fish are taken in large quantities in floss-silk nets. It is estimated that the annual catch is about 10,800,000 pounds.

The "soodak" or pike perch (*Leuciopercа sandra*) occurs in both seas and rivers, but is taken mostly in the Caspian Sea region, "where, however, it is caught, along with *Leuciopercа marinus*, Cuv., a sea variety; the fishermen make no distinction between them." The

average market size is about 5 pounds, and the maximum 25 pounds. The immense importance of this species (*L. sandra*) from a commercial point of view can be estimated when it is stated that 16,923,869 fish were caught in the Astrakhan region in 1897. Of these, 10,283,449 soodaks were taken in the rivers, and 5,640,420 in the sea.

But these figures are small alongside of those given for earlier years, for Baer estimated the number annually exported from Astrakhan, in the fifties, at 28,500,000 fish, weighing 90,000,000 pounds, and Dr. Grimm says "It is not so very long ago since 45,000,000 soodaks were exported from Astrakhan." In addition to the catch in the region named, large quantities are taken in the river Kooban, from which it is estimated some 7,000,000 fish are annually exported.

Lucioperca volgensis is another species of some consequence, as will be seen when it is stated that 5,802,383 fish of this kind were caught in Astrakhan in 1897.

The "Silure" (*Silurus glanis*) occurs generally in fresh waters, except in the White Sea region, but is most numerous in the south, in the Caspian Sea and Black Sea basins. It is very large, and is said to have attained the extraordinary weight of from 540 to 576 pounds, while the average weight is given at from 60 to 70 pounds. This species is of considerable commercial value, for it has been estimated that the total annual catch is 9,000,000 pounds. In 1897, 562,570 fish of this species were taken in Astrakhan.

The carp (*Cyprinus carpio*) inhabits the Caspian and Black Sea regions, including the Sea of Azov and the Aral Sea. It is utilized very largely for food. The statistics for 1897 show that 4,945,926 fish of this species were taken in Astrakhan. The weight of these could not be much less than 30,000,000 to 40,000,000 pounds.

Among the cheap, but nevertheless important, varieties of fish is the roach (*Leuciscus rutilus*) and the Caspian Sea species (*L. rutilus var. caspicus*). Another variety which inhabits the Caspian and enters the lower part of the Volga is the *Cyprinus grislagine*, Pall., while *L. heckelii*, Nordm, called "taran" by the local fishermen, is the Black Sea variety of the roach.

The roach is enormously abundant, and this, together with its cheapness, renders it a very favorite food when dried, so much so that it has been called a "national dish."

From 300,000,000 to 400,000,000 roach are caught in the Caspian Sea annually, according to Dr. Grimm, and he estimates that the weight of these, if dried, would be 108,000,000 pounds, or 259,200,000 pounds of fresh fish.

Some 100,000,000 of the Black Sea taran (*L. heckelii*) are caught in the Black Sea, the Don, and the Kooban.

Several other varieties of fish are known by the general term of "taran" beside that last referred to. Among these are the blue bream

(*Abramis ballerus*), the zope (*A. sapa*), but more particularly *Scardinius erythropthalmus* and *Blicca björkna*. This taran, as also the razor fish (*Pelecus cultratus*), when salted, is used in great quantities, chiefly by peasants of little Russia, says the author last quoted, and he estimates that 194,400,000 pounds of fresh fish is about the annual product from the Astrakhan district.

The catch of blue bream for 1897 was 25,239,890 fish, and of *S. erytropthalmus* it was 8,152,192 fish in the Astrakhan region.

The bream (*Abramis brama*) occurs in all sections of Russia up to the sixty-third parallel of north latitude. The catch of this species in Astrakhan in 1897 reached a total of 12,308,405 fish. The average weight has been placed at 3 pounds; thus the aggregate weight of the fish enumerated above would be nearly 37,000,000 pounds.

The pike (*Essox lucius*) is an important object of fishery. The catch at Astrakhan in 1897 aggregated 1,921,322 fish.

Lampreys are likewise of large commercial consequence in Russia, and are often used for food. The southern species (*Petromyzon wagneri*) is found in the Caspian Sea region and the northern variety (*P. fluviatilus*) is taken chiefly in the basins of the White Sea and Baltic. The last of these is pickled extensively. The southern lamprey was not taken as an article of commerce prior to 1870, except that a few captured in the Kur River were "dried and used for lighting instead of candles." It is now taken in great numbers both on the Kur and the Volga. "In Tsaritsin and Tcherniy Yar a small portion of the lampreys caught is pickled in kegs and in this form sent to the market, chiefly to St. Petersburg and Moscow; the greater part about five-sixths of the whole catch—goes for oil."[1]

It has been estimated that 50,000,000 lampreys, weighing from 5,400,000 to 6,300,000 pounds, are caught annually between Tsaritsin and Enotayevsk, and the yield of oil is placed at from 810,000 to 945,000 pounds.

The statistics given above, though far short of completeness, will nevertheless serve to convey some idea of the extent and importance of the Russian fisheries, particularly in certain regions. It may suffice to add that Dr. Grimm has estimated that the total annual catch for European Russia aggregates upwards of 40,000,000 poods, or 1,440,000,000 pounds in round numbers.

Considering that this estimate does not include any fish taken in Asiatic Russia, that it apparently excludes the product of mammal fisheries, like that for the seal, and having in view the lack of ocean fisheries, this showing is really remarkable, since the output nearly equals that of the entire product of the United States, which, in 1897, was given as 1,596,413,068 pounds.

[1] Fishing and Hunting in Russian Waters, p. 27.

The prosecution of the fisheries in Russia, especially in the Astrakhan region, is often conducted by large firms or individuals of great wealth, who have obtained from the Government or by right of ownership the privilege to control and carry on these industries within certain limits to the exclusion of all others. Such monopolies have proved immensely advantageous to those holding them.

As an instance of this kind, and for the purpose of showing how the fisheries are sometimes conducted on a gigantic scale in Russia, mention may be made of the Saposchnikov Brothers, a firm that for nearly a century has prosecuted the fisheries of the Volga, and which had a large and instructive exhibit at Bergen. This firm was organized by the Saposchnikov family for prosecuting the fisheries at the end of the last century, but was not officially recognized until 1819. Since that date it has been known by the name it now bears (Saposchnikov Brothers), notwithstanding the ownership has changed hands several times by heredity. The sole owner from 1887 to 1898 was the widow of one of the firm, and at her death the business was inherited by her daughters.

The enormous Saposchnikov fisheries extend from far up the river Volga to its outlet, and are generally carried on by drag nets (newood); fixed or floating nets are very little used.

The seasons for fisheries on the Volga are divided into four periods—from July 15 to September 1, from September 1 to December 6, from December 6 to March 1, and from March 1 to May 15, after which the close season begins and lasts up to July 15.

The yearly catch of this firm is more than 36,000,000 pounds of herring, and as high as 432,000 pounds of sturgeon, of different species. The total catch is said to be 2,750,000 fish of different kinds, and the fact that 763,000,000 pounds of salt are used for curing indicates the extent of the industry. The product is cured at the seven stations where its curing establishments are located, and is transported to and from these places by vessels owned by the firm. In summer its own steamers and barges carry the fish to Zarazin and Nizhni-Novgorod, and in winter 200 horses are used in transportation.

The business of the firm is administered by 200 persons, but as many as 2,000 people are annually employed during the fishing season in catching and curing. The employees are a mixture of Russians, Calmucks, and Kirgheezians, and the firm pays out more than $540,000 annually for wages a large sum when it is considered that the rate of pay is exceedingly low. The statement has been made that the annual catch in the waters of the Volga estuary, controlled by J. H. Basilevsky, is about 75,000,000 fish of various kinds, having a total value of 1,500,000 rubles. The firm employs 6,000 workmen, 1,800 workwomen, and 200 minors, and operates 100 drag seines, 8 steamers, 420

fishing boats, 4 barges, 6 lighters, and 11 vessels on which the fish are salted, etc.

Fishing vessels and fishing boats.—The vessels and boats employed in the fisheries of European Russia are interesting from an ethnological standpoint, for with rare exceptions they are quite unlike anything else in Europe, and are generally notably crude and primitive in form, construction, and rig.

Steamers.—Steamers appear to be little used in the Russian fisheries except for transportation or to tow barges that are loaded with fish products. In the early summer of 1898 I went on board the Russian steamer *Phönix*, from Riga, that called at Bergen on her way to the Murman coast to engage in the cod fishery. She was the first steamer, I was told, to take part in this industry. She was an old merchant steamer, and in no way a typical fishing vessel. It was explained that no fishing would be done on the vessel, but she would tow a fleet of boats to the fishing grounds, 30 to 60 miles distant from harbor, and lie there to receive the catch on board, where it was to be lightly salted, and subsequently it would be transferred to sailing freighters and sent to St. Petersburg. The fishermen—50 or 60 in number—would sleep on board. The summer fishery was to be prosecuted with trawl lines. From time to time the steamer and her fleet of fishing boats would return to port as the weather or obtainment of bait, etc., made necessary.

No models of steam fishing vessels were exhibited.

Sailing vessels and boats.—The vessels and boats employed in the fisheries of the Caspian Sea, of the rivers Don, Ural, Volga, and adjacent streams that empty into the Caspian Sea and the Sea of Azov, are of a peculiar rig, rather crudely built, and decidedly characteristic in type. They were numerously represented by rigged models exhibited by the Astrakhan board of fisheries, and also by photographs and lithographs.

Fishing vessels.—One of the largest fishing vessels used on the Caspian Sea is technically known as "emba kussovaya." This vessel is employed chiefly in the gill-net fishery, but to some extent for hook-and-line fishing. The maximum size of such vessels, according to Dr. Borodine, is 50 to 60 feet in length and 60 to 70 tons measurement. The following is a description of one of them: It is a wooden, carvel-built, keel vessel, with strong sheer; moderately sharp bow; straight, slightly-raking stem; full, round bilge; short, rather full run; little or no skag or deadwood aft; sternpost curved at an obtuse angle, raking strongly below the water line and being nearly perpendicular above. The vessel has a narrow, V-shaped stern, with a big slot cut in it at the top for the tiller to work in.

The rudder is hung outside to stout pintles. It is of heavy, awkward construction, with projecting flanges at the rear. It is supported on

CASPIAN SEA WELLED VESSEL.

the port side by a tackle, hooked to eyebolts at the upper part of the stern, and on the rudder post below the water line. It is also supported by guys leading from a brace on the after part of the rudder to each side of the quarter rail. It is operated by a long tiller, the after end of which is made with three prongs, one passing each side of the rudderhead and one going through the center. The steering is done by a tackle attached to the tiller. The vessel has low bulwarks and flush deck, except abaft the cabin house, where there is a low quarter-deck, while an open quarter rail rises above the main rail at this point and extends to the taffrail. There is a topgallant forecastle extending from the pawl bitt to the bow, and an old-fashioned windlass operated by handspikes. A high cabin trunk stands on the after part of the deck.

The vessel has one mast and a peculiar rig. It carries five sails—a jib, fore staysail, large square sail with a yard on its foot, topsail, and mainsail. The square sail is set "flying" or hoisted from the deck, as is also the topsail. The former has only one reef, which takes in about one-third of its area. The mainsail is set on a very long gaff, which is controlled by vangs leading down to each side of the taffrail, and is supported by a curious arrangement of halyards which closely resembles the rig used on English vessels three hundred years ago.

The following are the principal dimensions of a vessel of this type: Length over all, 52 feet; beam, extreme, 17 feet 7½ inches; depth of hold amidships, 6 feet; length of mast above deck, 63 feet 6 inches; gaff, 39 feet 6 inches; bowsprit, outside stem, 12 feet 7½ inches.

Bait smack.—A bait fishing vessel (fig. 136) is employed on the Caspian Sea, and is provided with a tank for keeping bait alive. This craft is essentially the same in form and construction as the vessel just described, differing, however, in having a very narrow, V-shaped, nearly perpendicular stern and less clumsy rudder, the tiller extending over the top of the stern instead of passing through it. In other details it also differs in having an open cockpit at the stern about one-quarter of the vessel's length and in not being provided with a windlass.

The most marked feature of a vessel of this description is a large hatchway amidships, and a great barrel-shaped tank, which extends from the floor to some distance above the top of the after part of the hatch. This has a covering, or top, like the head of a barrel, in which is a square hatch corresponding to the curb of the well on an ordinary smack, or welled vessel. This tank is considerably broader at the bottom than at the top, and is used for keeping bait alive for the Caspian Sea fisheries. The rig differs from that of the emba kussovaya in the following particulars: It has two jibs, the mainmast is somewhat farther forward, and on it is set a square sail and a topsail, as on the other. It has a mizzenmast about one-third the vessel's length from the stern, and on it is a diminutive leg-of-mutton sail, its luff being

attached by hanks to a stay that extends from the masthead to the deck. A four-pronged anchor is used. The ordinary vessels of this kind range from 36 to 40 feet in length, but some are larger.

The following are the principal dimensions of a vessel of this type: Length over all, 43 feet 4 inches; beam, extreme, 15 feet 10 inches; depth of hold amidships, 5 feet 10 inches; height of tank, 7 feet; diameter of tank at top, 5 feet 10 inches; mainmast, above deck, 45 feet 10 inches; bowsprit, outside stem, 13 feet 9 inches.

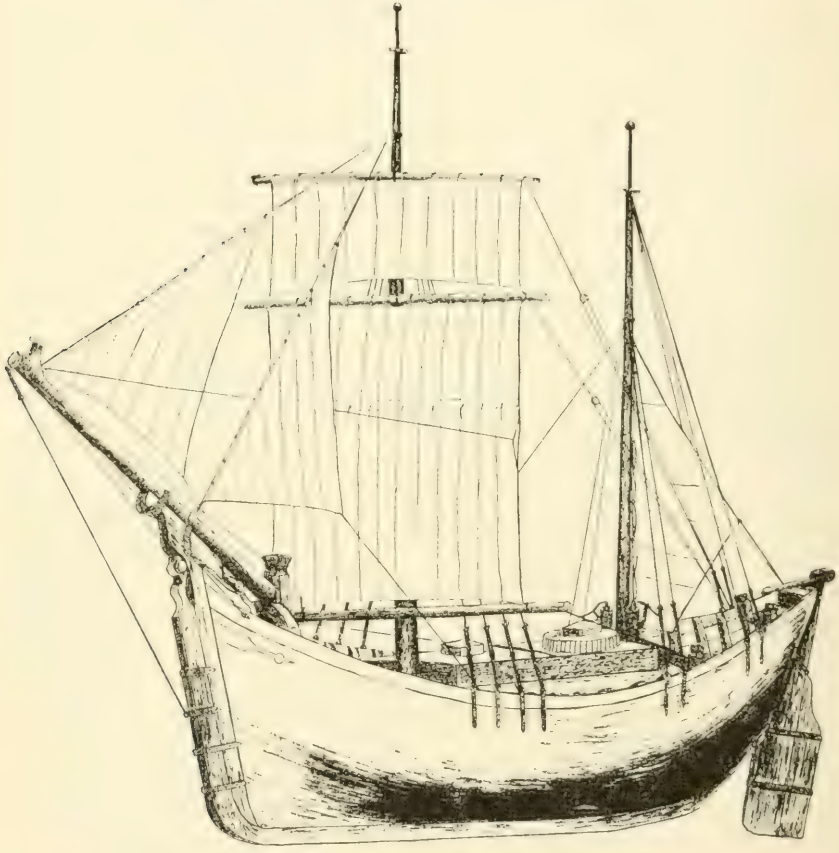


FIG. 136.—Caspian Sea bait smack. (Drawn by J. W. Collins.)

Caspian Sea fishing lugger.—A large two-masted lugger is employed in the sea fisheries in the northern part of the Caspian Sea (fig. 137). It has the usual high, sharp bow and narrow, V-shaped, square stern which characterizes the vessels of this region. It is decked, with the exception of a large open space at the stern. The cabin is in the after part of the decked space, and is entered by a door from the cockpit. Above the cabin, on the extreme after end of the deck, is a galley or "oven" for cooking, provided with a wooden-covered iron kettle.

Southern Caspian Sea fishing vessel.—A sharp-ended decked vessel (fig. 138) is used for fishing in the southern part of the Caspian Sea. It has straight, raking stem and sternpost, flaring sides, and strong sheer, its ends being much higher than the midship section. It has a large, square-heeled rudder, and steers with a tiller. It has a flush deck and low bulwarks. It has one mast, about two-fifths the vessel's length from the bow, supported by 4 shrouds on each side. On this is set a single large square sail.

Caspian Sea welled vessel.—Welled vessels of varying sizes, like that shown in Plate XXXVII, are used for fishing, or the transportation of living fish, in the Caspian Sea, but these boats do not go into the rivers, for the fresh water would kill the fish in their wells.

FIG. 137.—Caspian Sea fishing lugger. (From Russian lithograph.)

The carrying capacity of these vessels varies from 18,000 to 108,000 pounds of fish, and the difference in their dimensions corresponds.

As will be seen, the one under consideration has the usual form and construction of the Astrakhan fishing boats, with very large rudder. It has a flush deck, hatch, and long well curb, or deck opening, leading to the live-fish "tank." It is rigged with a small lug foresail set on mast standing just abaft the stem head, and a large dipping lug mainsail set on mast, standing about three-fifths of the boat's length from the stern. The luff of the sail is hauled forward by a bridle bowline when sailing close-hauled.

This boat is 51 feet 8 inches long and 17 feet $2\frac{3}{8}$ inches wide.

Astrakhan River smack.—The welled vessel shown in figure 139 is of the same dimensions, rig, and general construction as the one last described, and is used for transporting living fish for long distances on the rivers. It is decked, and differs in this respect from other welled boats used for river transportation, and also in having two masts.

All so-called "tank boats" usually have very large wells, occupying fully one-half the boat's length in the central portion. The water enters the well through a series of long, narrow, slot-like holes. The river boats are often, if not generally, flat bottomed, but the seagoing boats are usually round bottomed, though in each case the construction of the well is similar.

Fish freighter.—A fish freighter of a type called "podyesnaya" was among those exhibited. This type of vessel is used by the Caspian Sea

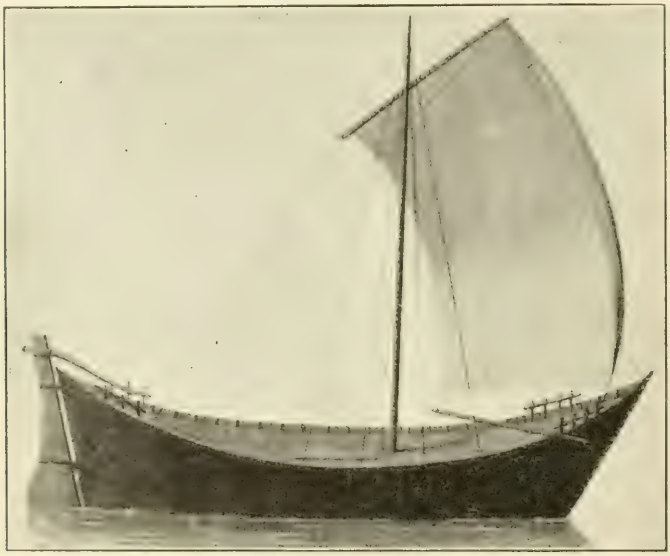


FIG. 138.—Fishing vessel of southern Caspian Sea region. (From Russian lithograph.)

fishermen for carrying fish to market. It is employed in connection with the seine fishery on the coast of the Caspian Sea, and ranges in size from 20 to 65 tons. It is not designed for a seagoing craft, for the reason that it is used only for carrying the catch of the seines to market. It is a carvel-built keel boat; rigged with three masts and carrying three lug sails. It is decked, except at the stern, where there is a steersman's cockpit; has a strong sheer; moderately sharp bow and stern, both ends being nearly alike in form, with the exception that it has the conventional, narrow, V-shaped stern. The upper part of the stem is also V-shaped, but much narrower than the stern. It has a rather low, narrow floor, round bilge, and flaring sides. The V-shaped stern is perpendicular and extends nearly down to the water

line, where it joins the sternpost, which, as in all the Astrakhan vessels, has a very strong rake. The wide rudder is hung on heavy pintles, and is operated by a tiller. The short foremast is stepped in a piece of timber that runs from the stem head to a beam a few feet farther aft, and the mast is supported on each side by a shroud set up by a tackle. The mainmast is a little more than one-third the boat's length from the bow, and the mizzenmast is just forward of the cockpit.

The dimensions of a vessel of this type are as follows: Length over all, 41 feet; extreme beam, 14 feet; depth of hold amidships, 4 feet 6 inches.

Caspian Sea line fishing boat.—A boat is used in connection with the

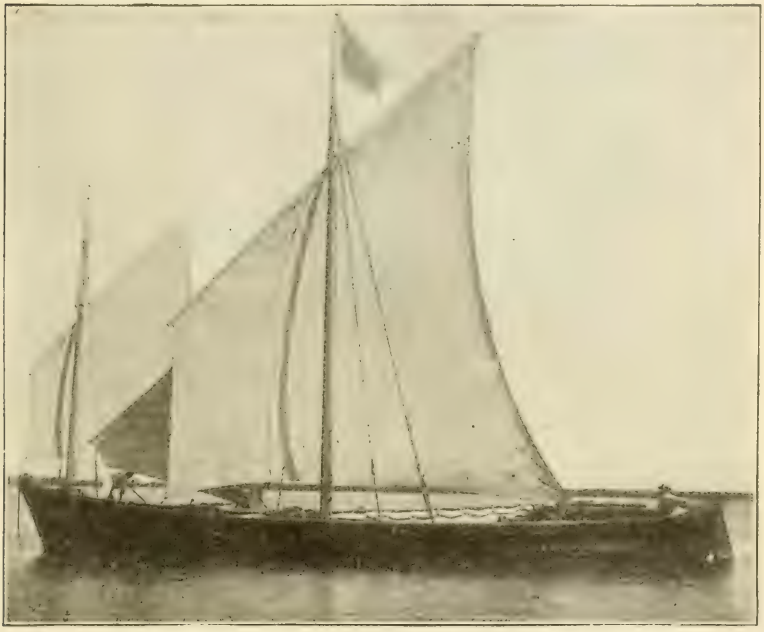


FIG. 139.—Astrakhan river smack.

bait-fishing vessel for operating fishing lines with hooks. It is a clinker-built, lug-rigged keel boat. It is decked, excepting a cockpit at the stern; has a moderate sheer; sharp bow; narrow, rising floor; and flaring sides. The after section is somewhat similar in shape to the bow; with a very narrow V-shaped vertical stern, and a straight, strongly raking sternpost. The stem is wide at the forefoot, but gradually narrows at the top and has a moderate rake. This is a feature of nearly all of the smaller Astrakhan fishing vessels and boats.

The rig is that of a three-masted lugger, though it is fair to say it is somewhat difficult to decide whether the sails should be classed as lug sails or settee sails. They resemble both, but are, perhaps, more

nearly related to the former, and this type of sail is practically universal on the small vessels and boats of Astrakhan.

The foremast is stepped just abaft the stem, the mainmast a little forward of amidships, and the mizzenmast about one-third the boat's length from the stern.

It has a half deck and cabin trunk abaft the mizzenmast. Abaft the cabin is a cockpit for the steersmen. For some distance forward of the mainmast the deck is nearly flush with the top of the rail, but beyond that the gunwale curves upward much more than the deck, making quite a deep bulwark at the bow.

The foresail tacks down to a ring at the stem head, the mainsail to a ring at a timber head on the weather side, and the mizzen in a

FIG. 140.—Caspian Sea long-line fishing boat.

similar manner. These sails have to be lowered and shifted whenever the boat tacks, and the rig adopted by the Russians is, therefore, extremely awkward and inconvenient in this regard, while the construction of the boats is crude and clumsy.

The relative dimensions of a boat of this class are as follows: Length over all, 35 feet 7 inches; extreme beam, 11 feet 3 inches; depth of hold amidships, 3 feet 9 inches; foremast above deck, 10 feet 4 inches; mainmast above deck, 20 feet 7½ inches; mizzenmast above deck, 14 feet 8 inches.

Caspian Sea long-line boat.—A boat of the common type, about 35 feet long, with very high bow, and decked except at the stern, is used for long-line fishing in the Caspian. The lines are set and hauled from a smaller boat of the same general form. Both of these boats are

illustrated in figure 140. The large boat is at anchor, and her lines and buoys are hung on a pole for drying.

Volga fishing boat.—In the lower part of the Volga a large two-sailed lugger of the ordinary Astrakhan type is used in the fisheries (fig. 141).

FIG. 141.—Volga fishing boat.

This is designed solely for river fishing. It has the following dimensions: Length over all, 35 feet; beam, 10 feet; depth, 3 feet 6 inches; foremast above gunwale, 11 feet 7½ inches; foreyard, 15 feet

FIG. 142.—Volga fish lighter.

10 inches; mainmast above gunwale, 23 feet 6 inches; mainyard, 28 feet 6 inches long.

Volga fish lighter.—Large, sharp-ended, open, flat-bottomed boats (fig. 142) are used as lighters on the Volga for the transportation of fish. They vary somewhat in size, but usually are from 35 to 40 feet

long and about 8 or 9 feet wide. They have a heavy, wide rudder and from three to five thwarts. They carry a large cargo on a light draft, and are useful for river navigation where the water is shallow. These open boats are, of course, quite distinct from the large decked barges—often several hundred tons—used for transporting fish products long distances, the former being utilized only for local river transportation.

Volga police boat.—The boat used by the government officials for inspecting the fisheries at the mouth of the Volga (fig. 143) is of the same general type as the fishing boats of the region, though perhaps with somewhat finer lines and a loftier rig. It has attained local celebrity for speed.

FIG. 143.—Volga police boat.

This boat is about 40 feet long, and is decked, except an open cockpit aft. It has a small cabin trunk at the after part of the deck.

Caspian Sea seine boat.—A large, open, flat-bottomed, skiff-like boat is used by the Caspian Sea fishermen to set the drag seines along the shallow shores of the sea. Its light draft adapts it to this work. It has a narrow, V-shaped, square stern; flaring sides; and a wedge-shaped bow, sharp below, but very narrow and V-shaped at top. It is entirely open, with short half-deck forward and aft, and four thwarts; three of these are well forward and one aft, the central portion of the boat being left unobstructed for stowage of the seine.

One of these boats was 36 feet long over all, 7 feet 4 inches wide, and 3 feet 6 inches deep.

Ural Cossack's boudara.—One of the most interesting types of fishing boats is the so-called "boudara" (fig. 144), which is used in great numbers by the Cossacks on the Ural River. Boats of this type, according to Dr. Borodine, are "so light that two of them may be carried on one cart." They range in size from about 20 to upward of 25 feet in length. One 23 feet long would be 4 feet wide and 20 inches deep. They are double-ended, sharp-pointed, canoe-shaped boats; entirely open; very sharp forward and aft, with slightly hollow water

FIG. 144.—Ural Cossack's boudara.

lines, and designed to attain the special objects of lightness and speed. A notable characteristic is the upward and backward turn of the sharp-pointed bow. The paddles used on the boudara are very peculiar, having a leaf-shaped blade.

Baudarka.—A boat called "baudarka" (fig. 145) was among the exhibits in the Russian section. This is a light built, open boat, with narrow, pointed, flat bottom; round bilge; flaring sides, and long, sharp ends. It has a good sheer, strongly raking stem and sternpost,

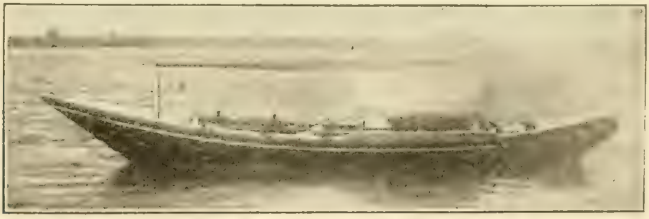


FIG. 145.—Boudarka.

but, as is usual with boats and vessels of this region, has a very narrow V-shaped stern. It has a single lug sail set upon a mast stepped a little forward of amidships. It is also equipped with oars and row locks.

Boats of this type are very generally used in the Astrakhan region. Often a small spritsail takes the place of a lug. The boudarka is generally about 20 feet long and 5 feet wide, but larger boats of this form are not uncommon.

Ural dugout.—A crudely made double-ended dugout is used in the fisheries on the Ural (fig. 146). This canoe is heavy and clumsy in comparison with the light and graceful boudara, and is usually somewhat larger than the latter. It has sharp ends, which curve up considerably and rake very slightly, and the bottom is round.

River Don fishing boat.—One of the fishing boats used on the River Don is especially interesting because of the importance of the river fishery. It is an open, carvel-built, flat-bottom, square-stern boat, and very clumsy in appearance. It has a moderately sharp bow; straight, raking stem; slightly flaring sides; a rather full run; straight, raking sternpost and V-shaped stern. The bottom is straight, without camber at either end, and the boat has very little sheer on top. This boat has three thwarts, and a small platform or half deck on a level with the thwarts at each end. Boats of this class are propelled by three pairs of oars. The rowers sit well forward, and each man evidently uses a pair of oars. The oars are of the conventional type, with the exception that they have heavy, square looms where they come in the

FIG. 146.—Ural dugout.

rowlocks. The steering oar, however, is very different, it having a lance-shaped blade and a peg on its inner end for a hand grasp.

The dimensions of this boat are as follows: Length over all, 25 feet 5 inches; extreme beam, 8 feet 6 inches; depth amidships, top of gunwale to underneath side of bottom, 5 feet.

Murman coast codfishing boat.—The boat (fig. 147) used in the cod fishery on the Murman coast, and particularly on the Russian side of Veranger Fjord, is unique, and not only differs from other Russian boats, but is unlike those of any other country.

Captain William Thompson, who spent some months on the Murman coast, says:

> The largest boats range from 35 to 40 feet in length, and some of them have a short after deck like the Norwegian "femboring," under which is a small compartment wherein food is cooked on a rude fireplace, made by laying flat stones in one corner of the "cuddy." The fishermen do little cooking, however, on the boat, the extent of their culinary operations being to prepare fish for food; for the meat, which is served to them only one day in the week, and the black, sour bread, which, with fish, constitute their principal food, is generally cooked on shore. With the exception above mentioned, the boats are open, and many of them are entirely so, not being provided with washboards, or any deck or platforms to keep out water or spray.
>
> These boats are clinker-built, and a curious feature of the construction is that the planks are fastened together with a soft line (about the size of manila spun yarn), which is made from the bark of a tree. The keel, stem, sternpost, and timbers are

usually made of birch, while the planks are pine or spruce. The coast where these boats are used is some distance north of the timber belt, and therefore the material of which they are constructed must be transported to the fishing stations from some part of the country farther south.

Many of the boats on the Murman coast are of a smaller size than the one above alluded to, and average about 25 feet in length. They are, however, of the same type as the larger craft, and are generally wider in proportion, and have a still stronger slant to the upper ends of the stem and sternpost.

The large boats usually carry a crew of 5 or 6 men, or 5 men and 1 woman, while the crews of the smaller craft average about 4 persons. It is not uncommon for women to be employed on boats.

The people who engage in these fisheries, with the exception of the keeper, who looks after the station, do not remain on the coast in

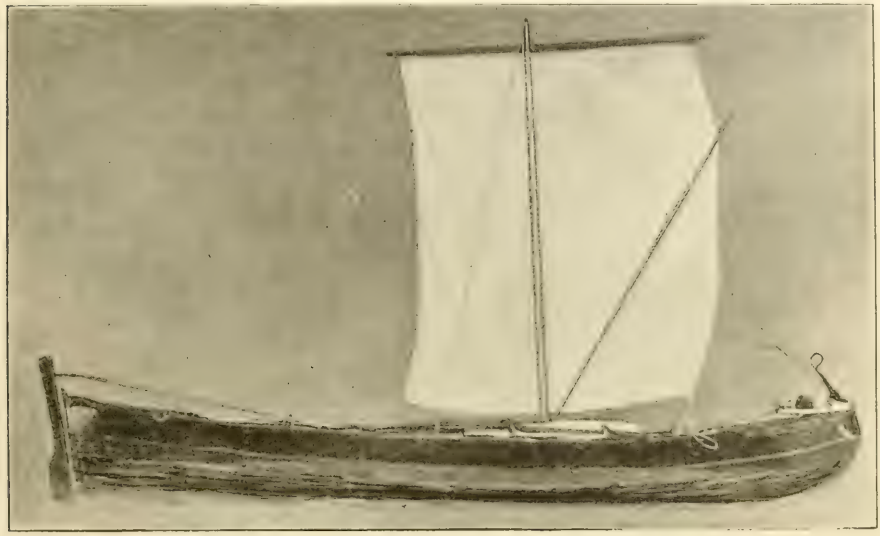


FIG. 147.—Murman coast codfishing boat.

winter, according to Captain Thompson. In the spring they reach the fishing stations by the means of reindeer teams, and at the close of the season, usually about the middle of September, they are sent home by the fishing companies on the Russian mail steamers by the way of the White Sea. The fishermen are paid from 60 to 90 rubles each for their summer's work, from March to September.

While at the fishing station they live in a squalid manner. They are not provided with bedding of any kind, and generally they sleep on shore in a building erected for the purpose. Wide shelves, which are elevated 3 to 5 feet from the ground or the floor of the building and having a gradual slope downward from the walls, are built up around the sides of the dwelling.

On these bare shelves or platforms the fishermen sleep, with their heads next to the side of the house, and without any covering other than that which they have worn during the day. In the side of the

building, which faces the sea, several large holes are cut just above the sleepers' heads, these apertures being so arranged that they can be closed with sliding doors. If a fisherman wakes and hears the wind whistling about the dwelling he immediately gets up, shoves back the slide that covers the hole over his head, and looks out to see if the boats are safely riding at their moorings. In this way a sort of half-waking, half-sleeping watch is kept over the fishing fleet, and the first indication of impending disaster calls the sleepers into action to prevent an accident to their property.

The Murman coast cod boat is clinker-built; open; has a sharp stern; shallow keel; rising floor, and flaring sides. The stem curves strongly and tumbles in at the top, while it has a great rake below. The bow is sharp and well formed. The sternpost is straight and nearly vertical. The ends are covered with tarred canvas, flush with the gunwales, for a distance of about 5 feet. The rudder and long yoke tiller are like those used by the Norwegians. The boat examined has six frames and a heavy bulkhead about one-quarter the boat's length from the

FIG. 148.—Seal hunters and boat. (From Russian print.)

bow. The mast is stepped between a crossbeam, which extends from gunwale to gunwale, and an open bulkhead. The boat is painted brown, except at top of bow and stern, where there are small triangular-shaped patches of yellow, bordered with blue. The blades of the oars are black and the looms green; the tiller is also black and green.

It has four rowlocks, like those on Norwegian boats, with oar beckets in them.

It carries a single loose-footed square sail, trimmed by yard braces and sheets. When close hauled, the lower part of the luff is hauled forward by a bowline bridle and the upper part is pushed forward with a sprit.

The dimensions are as follows: Length over all, 32 feet 11 inches; beam, 6 feet 8 inches; depth, 2 feet 5 inches; mast, above gunwale, 18 feet; yard, 15 feet; sprit, 16 feet 3 inches; mast, abaft stem, 12 feet 6 inches; oars, 13 feet 6 inches.

Seal fisher's boat. According to illustrations exhibited by Russia (fig. 148), the seal hunters of that country use a small, open, sharp-stern, clinker-built rowboat, which is hauled over the ice when the men

are in the pursuit of seals, and when, of course, there may be reason to anticipate meeting with open water. These boats are widest in the middle and taper gracefully at either end, the bow and the stern being very much alike. They are rather shallow, have a round bilge, curved stem and sternpost, and are moderately sharp forward and aft, with generally convex lines.

The seal hunters, with long, narrow snowshoes on their feet, make their way over thin or broken ice in pursuit of their game, their skiffs being dragged behind them by means of ropes. These have loops at their ends which are passed over the shoulders of the men.

The seal boat usually measures from 14 to 15 feet in length, 5 feet in width, and about 2 feet in depth.

Apparatus of capture, etc.—In a country so extensive as Russia and having such varied fisheries, it follows, as a matter of course, that there is a vast number of devices used for the capture of fish, marine mammals, and crustaceans, and also in the preparation of fishery products. The Russian exhibit included a large variety, the more important or interesting of which will be alluded to.

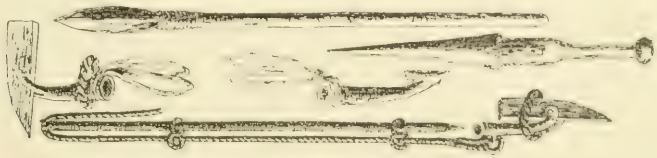


FIG. 149.—Harpoons and lances for killing white whales. (Drawn by W. H. Abbott.)

Whaling appliances.—The white whale (*Dalphinapterus leucas*) is captured in the northern seas with large seines, made of strong cord (Pl. XLIII), and with harpoons similar to those used for killing seals and walrus (fig. 149).

Sealing apparatus.—The illustration (fig. 150) [1] shows the various implements and dress of the seal hunters of northern Russia. The apparatus of capture consist of a large sealing gun, two forms of harpoons, spears or lances, and a combined ice pick and gaff. The gun is always provided with a cloth or leather lock cover, to keep the lock dry, and is also carried in a case, as a rule, when making passages on the ice, especially in stormy weather, for it is highly important to keep a gun dry. Fixed ammunition is not (or was not) used by the seal hunters, and a powder horn is a part of the equipment; wooden hoods or covers for the harpoon and lances are usually provided. Each hunter has a pair of long, narrow wooden shoes, pointed at the ends and turned up in front. They are not so long nor so light as the Norwegian ski. A sleeping bag, a small keg for carrying water in the

[1] From Investigations of Fisheries and Hunting for Sea Animals on the White Sea and the Arctic Ocean, published by the Russian Government.

boat that is hauled over the ice, and straps for dragging seals or pelts, complete the equipment. The strap is in two parts, to fit over each shoulder, and is provided with a loop and wooden toggle at the lower end, by which it can be quickly fastened to anything that is to be dragged.

The Caspian Sea sealers depend chiefly on guns, but a wooden club armed with many iron prongs at its head is also used.

Nets and seines.—The nets exhibited from Astrakhan were all made of hemp, and were coarse and primitive in comparison with nets of western Europe or America.

Machine-made nets and especially those made of cotton are little used in Russia, because of the excessively high duty on cotton goods

FIG. 150.—Seal hunters and apparatus. (From Russian publication.)

of all kinds. The few net manufactories in operation in Russia are equipped to make hemp nets chiefly, if not solely, for cotton twine is too expensive to use. Linen twine is used to some extent.

Various solutions are used for preserving nets. Herbs are boiled in lime water, and solutions of tar and oil are in favor. Much trouble is sometimes experienced in the Caspian Sea because of the nets rotting in an unaccountable manner, and very suddenly, to such a degree that when this happens it is called the "net plague." The matter has been investigated, but it is claimed the problem has not yet been solved, though Dr. Arustamon believes it is due to bacterial influences.

Von Kusnetzov says "the fixed nets and the drift nets are about the same mesh, width, and size. The fixed net is either fastened to poles

or an anchor, or fastened by ropes to stones." He speaks of the trammel net being used in Livland. Among the drift nets, he refers to a net which must be something like the parenzella, for it is drawn by two boats sailing parallel to each other. This net is "jarygi" on the Ural, but on the Volga it is known as the "poesduchi," "poesdy," or "bulgaki." It is often operated in places where no other apparatus can be used. In such cases it is set as a fixed net in a half circle around a certain place, and the fish are frightened into it by throwing stones in the water, etc.

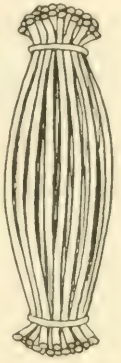


FIG. 151.—Reed float. (Drawn by W. H. Abbott.)

The nets used by the fishermen at Rostoff, on the River Don, are made of coarse hemp twine and hung to a single hemp rope. Wooden floats are used on these nets, these being of various shapes. Sometimes they are flat, but more frequently half oval, being simply a section of a round stick split in two. The flat floats averaged about 3¾ by 2½ inches on the surface and were three-fourths of an inch thick. The others averaged about 2¼ inches by 3 inches on the flat surface and were about 1¼ inches thick. These floats have a hole in the center through which the cork line passes, and they are strung on to the latter at distances from 6 inches to 1 foot apart. Some of the nets were made of linen twine, and the floats were made of from four to six sections of a large dried reed, somewhat resembling a cornstalk, these floats being about 8 or 9 inches long by 1¼ inches in diameter, and the reeds being firmly bound together at the ends by strong hemp twine (fig. 151).

FIG. 152.—Gourd net-buoy and float.

The sturgeon nets were made of coarse hemp twine with a mesh of 20 inches. Reed floats were also used on these, the floats being 10 inches in length and attached to the cork rope by twine seizings passing around each end of the float.

The gill net used in the River Kur for the capture of schamaja (*Alburnus chalcoides*) has a mesh of 1⅜ inches and is hung by reeving the head rope through the meshes. Small gourds are used for floats and large ones for buoys. These are held by lines hitched over them (fig. 152).

The salmon drift nets used in the Petschora River and the salmon nets in the White Sea region have flat wooden floats, some of them circular and some elongated, with the upper and wide end rounded, and the lower end square and made to fit the cork rope to which they

are fastened. The buoys of the Petschora nets resemble a four-leaf clover, with a staff through the center.

For sea and river fishing at Puski, in Northern Russia, the gill nets are hung by passing a stout line through a number of the meshes and hitching it to the cork rope at intervals (fig. 153), and the floats are made of birch bark wound tightly around the cork rope, so as to make an elongated roll, which may vary in size in proportion to the dimensions of the net. According to the best authorities, the nets usually have no footrope, and the stone sinkers are fastened to loops or strings attached to the bottom meshes (fig. 154).

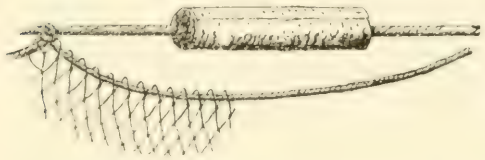


FIG. 153.—Birch-bark gill-net float. (Drawn by W. H. Abbott.)

Trammel nets are in favor in some parts of Russia for certain fisheries. The method of hanging these is to reeve a line through the small and large meshes, and where the large meshes come a cord is passed around the cork rope, which in turn is rove through the floats (fig. 155). The net is hung to the footrope by reeving the latter through the meshes. In some places, however, a sinker made of gravel incased in cloth is used (fig. 156), and then a lashing goes through the large meshes and around the sinker, thus holding the meshes from slipping.

FIG. 154.—Method of fastening sinkers. (Drawn by W. H. Abbott.)

Many curious and interesting forms of sinkers are used on the Russian nets. In one case two pieces of burnt clay were fastened to opposite sides of a pole $4\frac{1}{2}$ feet long (fig. 157), which was attached to the wing of a seine. These sinkers were at the lower end of the pole, to keep that end down and aid in keeping the stick nearly vertical in the water. This is an Astrakhan device.

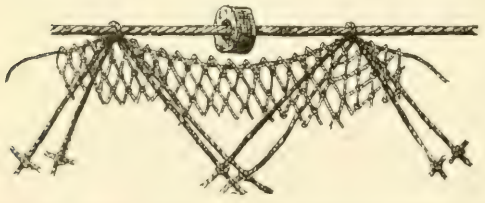


FIG. 155.—Method of hanging trammel net. (Drawn by W. H. Abbott.)

A sinker used on an Astrakhan net was a piece of sheet lead about one-sixteenth of an inch thick, bent around the lead line of a net and hammered closely to the line (fig. 158). This bore evidence of having been cut with a die.

A net used for catching smelt (*Osmerus operlanus*) and white fish

(*Coregonus albula*) had bright-red burnt-clay sinkers, 1¾ to 2 inches in diameter and ¾ to 1 inch thick. These had a hole in the center, through which the line passed that held them to the net. Figure 159 shows one of these sinkers in profile and cross section.

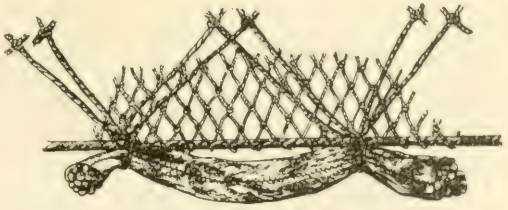


FIG. 156.—Section of gravel net sinker. (Drawn by W. H. Abbott.)

A sinker very much like the latter, but less regular in outline, with a hole in the center, was made of soft stone, possibly gypsum. Its average diameter was 1¾ inches; average thickness, ½ inch.

A smooth, well-made, oblong sinker, with corners ground off (fig. 160), was 4 inches long, 2½ inches deep, and 1¾ inches wide. It had two holes near the center for the line to pass through.

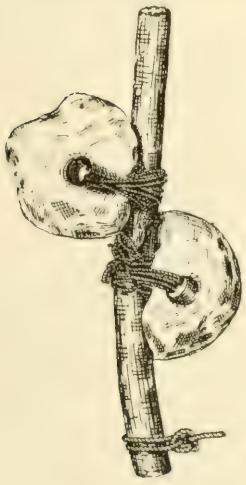


FIG. 157.—Seine-pole sinkers. (Drawn by W. H. Abbott.)

A tubular sinker (fig. 161), varying in length from 2¾ to 3⅛ inches, central diameter about 1¼ inches and ends ¾ inch, is used to a considerable extent. This is a rather conventional form, and resembles the tubular lead sinkers used in the United States and western Europe. A number of these are strung on the footline, and a wooden wedge is driven in the end, or ends, of the sinker, to jam the rope so that it will not slip.

In figure 162 is shown two kinds of sinkers on one net, indicating the expedients often resorted to where stones of suitable shape are not obtainable. One of these sinkers is incased in birch bark. This is often done to prevent the net or footrope from being chafed, as they might be on rough stones. The other is a piece of terra-cotta, with a hole near one edge, through which passes the line that holds it to the footrope.

An egg-shaped sinker (fig. 163) is used in some sections on the corners of a "bag net." The peculiarity of this is that it is covered with cloth, doubtless for the reason already mentioned. The method of attaching this to the corner of a net is shown in the illustration.

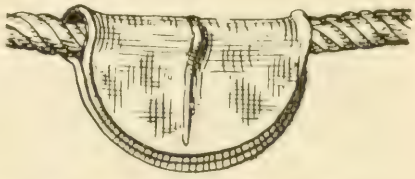


FIG. 158.—Sheet-lead net sinker. (Drawn by W. H. Abbott.)

The so-called sink seine, like that of the Norwegians, is used on the Murman coast. It is about 90 feet square, and is operated by four boats (fig. 164).

The drag seine of the Caspian Sea region is made of coarse hemp twine, with a mesh of $2\frac{3}{4}$ inches. The net is hung to a single three-quarter-inch hemp rope on both foot and head, and along the cork rope floats are placed, at a distance of about 9 inches apart. The footrope is provided with circular iron sinkers at intervals of 8 feet apart. Each of these has a hole in the center through which the footrope is rove. This seine is about 9 feet deep, as hung.

FIG. 159.—Net sinker. (Drawn by W. H. Abbott.)

According to Kusnetzov, drag seines are employed in all large fisheries. The simplest form of this apparatus, which is only a straight net hung to stout lines, is called "bredni" or "brodni." This is usually a shallow seine, like that last referred to, and is generally used in places where the fishermen can wade out to operate it, particularly to pull it to shore.

A common form of Russian drag seine has a bag in the bunt, into which the catch is gathered when the net is brought to the shore. The bag has a smaller mesh, and is made of larger twine than the rest of the net, and generally the mesh of the bunt, next the bag, is smaller than it is in the wings.

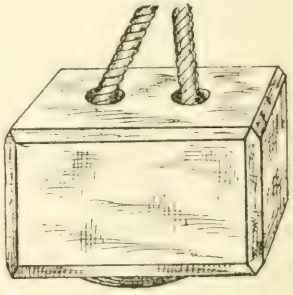


FIG. 160.—Net sinker. (Drawn by W. H. Abbott.)

The size of the mesh, of course, depends upon the species the net is employed to capture, and may vary from a fraction of an inch for some of the smaller species to many inches for white whales. A special kind of seine, with the bag nearer one end than the other, is used for catching salmon in the White Sea region, and in the northern part of Russia are also seines or bag nets with only one wing. Some of the bag nets have very short wings, especially those used in the White Sea and Arctic Ocean for catching salmon. The latter are generally fixed apparatus, each wing being held by loops to a stake driven into the bottom, and the upper corner of the bag is extended in the same manner by a line fastened to a loop or strap that runs on a stake fast in the mud. The lower part of

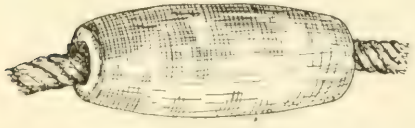


FIG. 161.—Net sinker. (Drawn by W. H. Abbott.)

this form of bag net is kept to the bottom by large stone sinkers, and the upper edges are provided with floats to keep them up in the water.

Cast nets, fykes, traps, weirs, etc.—There are many forms of fishing apparatus used in Russia which may properly come under this head, for here we find not only modern types of gear but many forms which seem to be aboriginal, or at least they differ from fishing appliances seen elsewhere.

FIG. 162.—Net sinkers. (Drawn by W. H. Abbott.)

Cast nets.—Cast nets are used in the Caspian Sea region, and are thrown essentially the same way as in the southern section of the United States, the fisherman holding one part of the lower edge in his mouth, thus gaining the leverage to whirl it out into a mushroom shape, so important for catching fish.

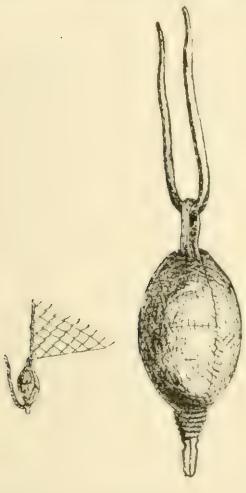


FIG. 163.—Net sinker, etc. (Drawn by W. H. Abbott.)

These nets differ from the American forms in having a peculiar plait-like edge, weighted with lead, but with no puckering strings, its effectiveness depending on holding the fish within the full plaits of the edge until they can be removed. At least those nets exhibited in the Russian section had no puckering strings, or brail lines, running to the lower edge, and I was assured such were not used. Still in the volume of illustrations on the Caspian Sea, already referred to, the detailed drawing showed the end of a brail line fastened to the foot line.

Cast nets are used both from the shore and from boats. Of course fish must be close to the surface for a device of this kind to be operated successfully by men on the shore. When cast-net fishing is attempted two men usually go in a

FIG. 164.—Sink-seine fishing. (From Russian publication.)

boat. One sits forward and slowly pulls the boat along—or backs her, if circumstances demand it—and the other stands ready to cast the net whenever fish are seen. Sometimes a boat may be fastened to a stake

that is driven into the bottom, and she lies quietly while the men wait for approaching schools of fish.

In any case much dexterity is required and is shown. The fisherman has one end of the coiled line tied around his left wrist, and with the whirling motion acquired only by long practice, he sends the net far out from the boat—the entire length of the line—and so accurately that it rarely fails to strike the water fairly and in the right place. It necessarily follows, however, that all such fishing is comparatively unimportant, considered alone from the standpoint of commercial fisheries.

Fyke nets.—Fykes are generally used in Russia. Some are of the ordinary pattern, having circular hoops, some have square frames, and others still have frames which are a compromise between the two. They vary in design, as elsewhere, some being simple in construction, with only one funnel, while others are longer and more complex, and have several funnels. Very large fykes are used in some places. In Lake Ladoga, for instance, it is common for them to be 70 feet long, with a diameter of 20 feet. "On the Volga," says Kusnetzov, "the fyke nets sometimes have wings extending not only sidewise, but also downward, toward the river bottom, and in this manner the whole water run may be closed in from the bottom and up to the ice covering the river or lake."

It is rare that fykes are set singly, but they are usually put out in rows, so that their wings connect and overlap each other and form an intricate labyrinth of netting, thus making escape for fish practically impossible, and often resulting in large captures.

In the northern part of European Russia—that section bordering the White Sea and Arctic Ocean—the most effective devices are used in the rivers for the capture of fish. Indeed, so comprehensive and destructive are some of the obstructive apparatus, such as barriers, weirs, etc., that one feels it must be almost impossible for a fish to pass up a stream to the spawning grounds at the headwaters, and it is difficult to understand how this system of fishing has been pursued for many years without causing a serious depletion in the abundance of species sought.

A common form of apparatus used in river fishing is the fyke-net weir, or trap. On the Zilmar River a fyke weir is in favor for the capture of ordinary forms of fish. It is composed of a long leader extending across the current and well out into the stream. This is made of alternate sections of brush, or sticks, driven into the mud, and netting. In the center of each net section is a fyke net, arranged in opposite directions, so that one will catch fish passing up the river, and the next will take them when they are swimming downstream. The leader is supported by stakes driven into the river bottom, and

the fykes are so fastened to stakes that they can be lifted, as occasion demands.

On the Kubino Sea a double fyke net is used. The fykes have a large broad-mouthed funnel at the entrance, and an inner funnel. Two of these are set facing each other, and are connected by a leader of netting; the upper edge of the latter is supported by floats, while the foot line is kept near the bottom by stone sinkers. The fykes are fastened at each end to stakes in such a way that they can be raised when necessary, and reset without changing their position.

Fish passing along the coast, or in or out of a cove or estuary, are liable to meet with the leader, and whichever way they turn, if they follow the leader, the probability is that they enter the fyke. Such a device can not fail to be effective where the conditions are suitable to its use.

The "ssisha."—This form of fish trap (which is also called "ssjesha") "looks exactly like a purse net. It is fastened to poles and arranged in such a manner that it is impossible for fish to escape which have once entered the net. A small line extends from the center of the net, and is held by a fisherman stationed on the shore. This line gives the signal for each fish that enters the net, and sometimes a little bell is attached to the signal line, and this gives a light tinkling sound whenever a fish enters."[1]

Black Sea fishing trap.—A trap is used on the bays of the Black Sea for catching mackerel and other species, which is supposed to have been derived from the Greeks, but is similar in idea to apparatus used by the people of various countries bordering the Mediterranean. It is called "dal jani" or "skipasty" by the Russians. It is a large trap, and costs from 500 to 800 rubles. It is built like a pound net; the netting is attached to poles, and anchors are used to hold it steady. It is arranged in "what might be called a whole court," says Kutzenov, "the entrance to which is opened by letting down one of the walls formed by the nets. If a school of fish enters, the entrance is closed again by hauling the net well up the surface."

Fishing mats.—A system of fishing with mats called "rogoshke" is practiced on the Black Sea, and is quite unlike anything I have known of elsewhere. The mats are made of reeds, and are about 14 feet long. The edges along the sides are curved upward to a height of 4 inches. This gives them the appearance of large, oblong, low boxes when floating on the water, a form necessary to the purpose for which they are used. "On dark nights these mats are silently put on the surface of the sea, forming a half circle, and placed where fish are sure to be found. The men in the boats then proceed to scare the fish up from

[1] Fischerei und Thiererbeutung in den Gewässern Russlands, by Von I. D. Kusnetzov, St. Petersburg, 1898.

the bottom of the sea by shouts and noises and by beating the surface with the mats. The frightened fish, which have been driven toward the mats, try to jump over the imaginary obstacles and thus jump onto the mats, where they are easily caught by the fishermen, for the bent edges prevent their escape."[1]

Strange as this device may appear for the capture of fish, the success met with is often most gratifying, and instances are not uncommon when so many fish spring upon the mats that the latter sink.

Dip nets and scoop nets.—The dip nets and scoop nets are evidently made by the fisherman as a rule, and are of primitive construction. Metal bows are not much used. A metal-bowed scoop net of a very conventional form is used in the preparation of caviare in Astrakhan. Ordinarily the bow and handle are formed of a two-branched sapling, cut of sufficient length for the purpose. The bark is first stripped off, one of the branches is cut quite short, and its end is chamfered; the other branch is left of suitable length to make the bow large enough, and its end is also chamfered to fit the other. Then the long branch is bent to meet the short one, and the two are firmly joined by seizings of line, thus forming an ovate bow of greater or less proportionate width, according to the flexibility of the wood or the fancy of the maker. If neither of the branches is long enough to form the bow, as above described, they may meet in the middle (fig. 165), although this is undesirable because the lashings chafe off quickly, and it is generally preferable to leave both ends short and chamfered and fit a flexible piece to them to form the bow. Of course it is best to have saplings that divide at the top into two symmetrical parts or branches, but such are not always available. In that event a small tree with straight stem is selected which may have two branches on opposite sides and nearly at the same height. The top of the tree is cut off just above the branches and the latter are tapered to receive the ends of the bow piece, which are lashed in the ordinary way. The bow of a dip net used on the River Don was made of hardwood bent into the usual ovate form, the ends being chamfered and secured by seizings to the ends of a branched Y-shaped stick, the other end of which was strongly fastened to the wooden handle of the dip net. The greatest diameter of the bow was 2 feet, and the least diameter was 14½ inches. The handle was 4 feet 9 inches long and 1¼ inches thick. The bag-shaped net was made of very coarse hemp twine, with mesh of 1¾ inches.

FIG. 165.—Dip net. (Drawn by W. H. Abbott.)

Thus, though the details of construction vary somewhat, the ulti-

[1] Fischerei und Thiererbeutung in den Gewässern Russlands, by Von I. D. Kusnetzov, St. Petersburg, 1898.

mate result is the same, so far as the general nature of the handle and hoop of the net are concerned. The attachment of the net is a secondary matter, and this may be woven onto the hoop, or may be previously prepared and simply hitched on in the usual way. A large dip net (fig. 166), similar to the shrimp nets of France and Great Britain, is used for fishing along shore in shallow water. The handle is 14 feet long; head (or spreader), 4 feet long; inner spreader, 18 inches long; net, 6 feet long 4 feet wide at head and 18 inches wide at inner part.

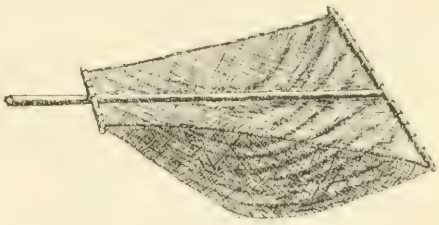


FIG. 166.—Dip net. (Drawn by W. H. Abbott.)

Trawl lines.—The trawl lines used on the Murman coast for catching cod and other species differ in no essential particular from the Norwegian lines. Indeed, it is quite supposable that the Russians have copied after the Norwegians in the preparation of their fishing lines, as they have in most other things connected with cod fishery. Figure 167 shows a section of trawl line coiled on a stick with the bights of the gangings hitched over the hooks to prevent entanglement. The methods of hitching is shown more clearly in figure 168, which indicates that one method is a clove hitch and the other is a slip hitch.

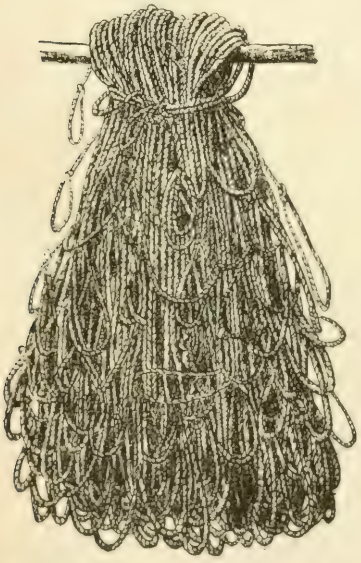


FIG. 167.—Trawl line. (Drawn by W. H. Abbott.)

At least two forms of trawl lines are used for catching sturgeon. The hooks on both have long needle-like points, and are seized to the gangings. One of the lines, however, has barbless hooks, while the hooks on the other have very small barbs. The latter are used in the Caspian Sea, and are set floating; the ground line is supported at short intervals by wooden floats or buoys, and the hooks are allowed to hang down where the sturgeon will come in contact with them.

The trawl line used for taking the sterlet on the Volga has barbless hooks. This is set at the bottom of the river, the ground line being kept down by stone sinkers placed at intervals along it, while the hooks are supported in the water for the length of the gangings by

small cylindrical wooden floats, one of which is attached to the bend of each hook by a small double line 12 or 15 inches long.

Barbless hooks are also used on long lines for the larger species of sturgeon. These are attached to ganging lines, or snoods, which are about the size of ordinary cod lines. The snoods are about 16 inches long, and are bent to the ground line at distances of 8½ to 9 inches apart. The ground line is the size of the buoy line commonly used by American trawl-line fishermen. These sturgeon trawls are set floating, and have attached to them at regular intervals buoys or floats such as are put on the nets, three of these being in a bunch at distances of about 5 feet apart. This variety of trawl is not baited. It is set a short distance above the bottom so that the hooks may intercept the fish that are moving about in the vicinity. When a sturgeon comes in contact with one of the sharp-pointed hooks it quickly enters his body. Stung by the pain, he naturally struggles to free himself, and soon he is impaled on other hooks, and finally is wound up in the gear and rendered helpless. The struggles of one fish generally result in catching others that may be near, for, as he sweeps the trawl back and forth, he is almost certain to fasten the hooks into some other sturgeon.

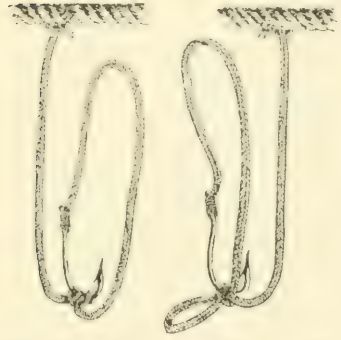
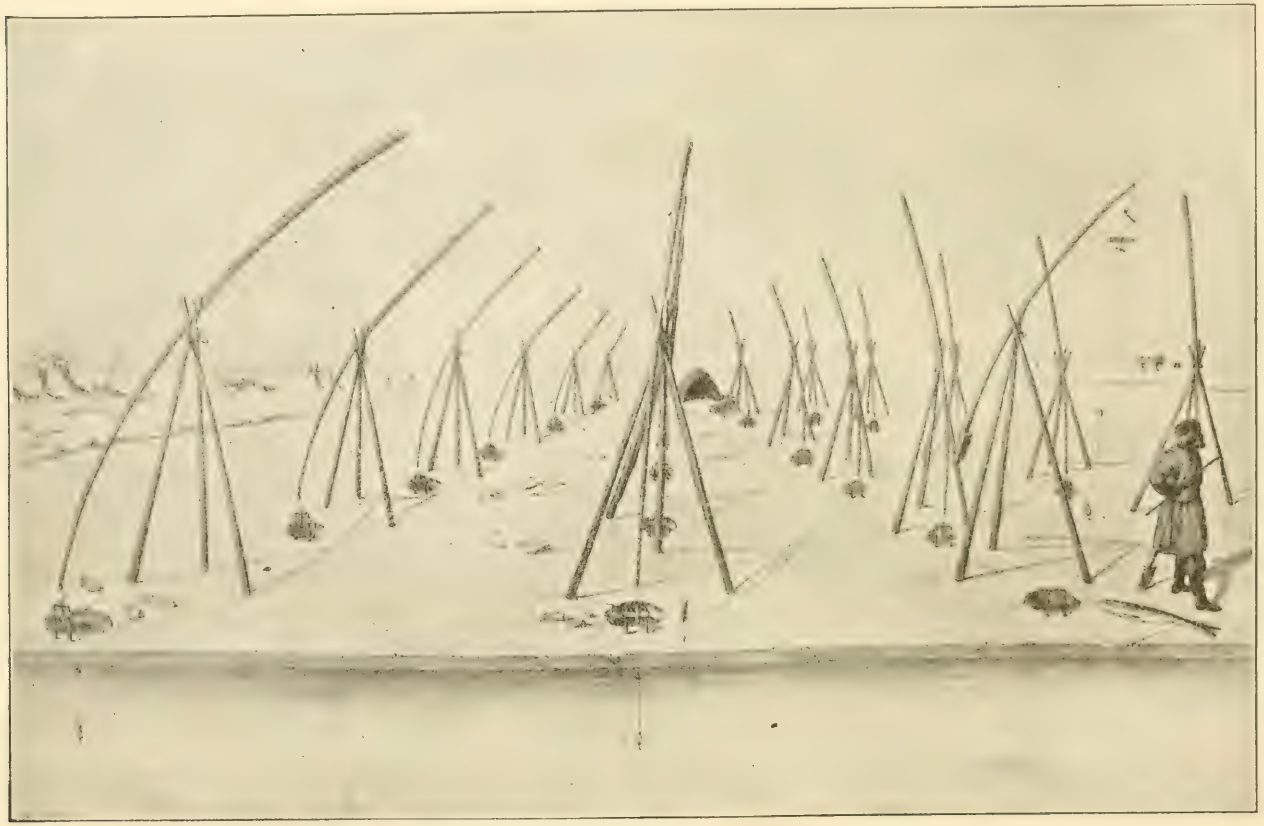


FIG. 168.—Method of hitching hooks. (Drawn by W. H. Abbott.)

Hand-line gear.—There is a great variety of hand-line gear in Russia, much of it being designed for the special purpose of fishing through the ice. In a country of such vast extent as Russia, and situated so far north that its inland waters are covered with ice a greater or less portion of the year, it follows that ice fishing on lake and river is carried on to a large extent. In this, as in other affairs of mankind, necessity is the spur that prompts effort, and the ice barriers that float on stream or lake, or even on large estuaries, are not sufficient, formidable as they may appear, to prevent the greatest activity in effecting the capture of fish by various devices, among which may be mentioned lines, gill nets, bag nets, seines, etc.

It seems a somewhat simple matter to cut a hole in the ice if a suitable implement is to hand, and to secure success by angling for the fish whose appetite has been sharpened by fasting. And so it is a common thing in Russia for men to fish in this way and to carry away their catch on sleds. But while this method may serve to supply the fisherman himself, and possibly he may obtain a considerable surplus, line fishing through the ice, to be commercially important, must be carried on upon a much larger scale, with an arrangement whereby one man can attend to many hooks, and thus multiply his catch.



ICE FISHING ON THE VOLGA.

From Russian publication

For this purpose, therefore, numerous devices are resorted to in the shape of semi-automatic fishing apparatus for catching fish through the ice by hook and line. Among those that are used on the Volga in winter is one of the most interesting and effective, inasmuch as it enables a single person to attend many lines and thereby to multiply his individual catch (Pl. XXXVIII). The species chiefly taken in this way on the Volga are the yellow perch (*Perca fluviatilus*), the pike perch (*Leuciopercu sandra*), and the white salmon (*Luciotrutta leucichthys*).

The apparatus consists of a "boom rod," a curved pole resembling an old-fashioned well sweep, with one end much larger and heavier than the other, and sometimes with additional weights attached, balanced on a tripod made of three poles fixed in the ice so that they slant at a proper angle for their top ends to cross. These ends are tied together firmly a foot or so from their tops, and where they separate above the lashing the boom rod rests. To the small end of the latter is bent a fishing line, having at its lower end a hook with a fish-shaped tin decoy cast on its shank. Various kinds of hooks are used, some are barbless, some have a harpoon-shaped point and barb, and others are of the usual Astrakhan form, with long, sharp point and small barb. In order to set this gear so that it will be in position to catch fish, a sort of trap-like device is arranged for holding down the small end of the boom, but in such a way that when a fish bites and brings a strain on the line the boom is released and allowed to tip, by the fall of the heavy end, thus raising the fish through the hole in the ice. To accomplish this the points of an inverted U-shaped wooden bow are secured in the ice close to the edge of the hole through which the line passes. Attached to the line near the end of the boom are three small pieces of wood, one is flat and long enough to reach across the U-shaped bow to which it is held by the strain of the boom upon the line; one is the so-called "knocker," a plug showing when a fish has bitten, and the other is the "resting plug" for the line.

When the apparatus—tripod, boom, line, and trap—has been prepared a hole is cut in the ice, the hook is dropped into the water, the boom is pulled into position, the trap is set, and the fisherman goes off to attend to other similar devices, of which he may have many. If fish are plentiful, the first hook put out may be taken before all are set, and thus the fish are brought out on the ice to quickly freeze, when they are carried away on sleds. Yellow perch, and probably other species, are caught through the ice by ordinary angling on the Volga, and doubtless are taken in the same way in nearly all sections of Russia.

For this a decoy hook, with a fish-shaped piece of tin on its shank, is used. The line is held in the hand, or bent to the end of a short

flexible rod. An ax, or chisel, to cut the ice, and a sled to haul the catch away are necessary adjuncts.

Several very primitive and curious forms of gear for catching yellow perch through the ice in northern Russia were exhibited. The lines were made of twisted horsehair. One of these was attached to a pole, 2½ feet long, that had evidently been made for the purpose, the upper part being much thicker than the lower end, and having wooden pegs in it upon which the line was wound. The line was 8½ feet long; it was bent to a conical lead sinker, 2 inches long and ⅝ inch diameter at lower end, but tapering to a point above, where the line bends into it. Fastened to the lower end of the sinker is a metal spreader, 4½ inches long, having a snood at each end, 4 feet long, bent to horsehair loops at ends of spreader. Small round-bowed hooks are used. A similar line, 9 feet long, with a smaller sinker of the same shape but no spreader, was wound on a rough piece of sapling, 26 inches long, the limbs being cut so as to leave them projecting far enough to wind the line on, while the limbs at the extremity were left long enough to be fastened together, forming a guide for the line to pass through. The line was the same length as the other, and the sinker was 1½ inches long and ½ inch diameter. One inch above the sinker is bent the single snood, 13 inches long, made of three twisted horsehairs, and the Kirby hook is 1 inch long.

The third line was 29¾ feet long, and was wound on a rough stick 19 inches long. The sinker was simply a plain, thin squid 1¾ inches long and ⅝ inch wide, on the shank of the hook.

One form of hand-line gear, used for ice fishing on the rivers of the Caspian Sea region, has four or five hooks bent to snoods attached to the line and a hook bent to the end of the line. A foot or so above the latter is a stone sinker, sufficiently large to keep the line down in the current. In this case a small branch of a tree is fixed in the ice near each hole, and the end of the line is fastened to that.

A crude sort of spreader gear is used for catching smelt (*Osmerus eperlanus*) and *Gadus navaga* through the ice on the White Sea, or at the mouths or estuaries of rivers of Northern Russia. The curious reels upon which the lines are wound, the form of the gear, and the method of fishing on the ice in vogue in the White Sea region are shown in the illustration (Pl. XXXIX).

A very primitive kind of gear is made in the North for catching the burbot or "guappen" (*Lota vulgaris*) in winter. The hook is made in Y shape from a small branch of birch, and the ends are pointed. The one exhibited was 2¼ inches long, with a spread of ¾ inch. This is attached to a snood 10¼ inches long, which is bent to the line 18 inches above the sinker. The latter is a piece of burnt clay, nearly spherical in form, with a hole through the center. It is 1¾ inches greatest diameter, and the hole is ¾ inch in diameter.

ICE FISHING ON THE WHITE SEA.

From Russian publication.

The most curious and peculiar specimen of fishing gear exhibited by Russia was, perhaps, a device used for catching burbot on the Peipus Sea. This is a sort of jig, made of 10 hooks mounted (or cast) in the base of a lead sinker, so as to point in different directions, nearly at right angles to the sinker, and with their ends curved downward. These hooks are made of ordinary wire bent to the required shape; they are each 4 inches long from the sinker to the bend, are sharp-pointed, and barbless. Next the sinker fine brass wire is woven in and out on the shanks of the hooks, something like a spider's web, for about an inch, to hold them more firmly in position. A circular metal ring passes through a metal eye in the top of the sinker, and attached to this, like links of chains, are three more similar rings, the line bending into the upper one. Fastened to these rings are jingles, made of strips of tin rolled up, and small brass bangles, etc. The purpose of these jingles is to attract the fish, for it is supposed that the noise made by jerking these up and down in the water is similar to that made by the crawfish or "krafta" (*Astacus fluviatilus*) with its claws. The krafta is a favorite food of *Lota vulgaris*, which is thus drawn to the jig, the appearance of which, with its many hooks bending like legs, may heighten the deception and lead to the capture of the species sought.

A soft-laid, two-stranded hemp line, 14 feet long, is used. This is wound on a curious recurved handle, which serves the purpose of a reel and fishing rod. The handle is $9\frac{3}{4}$ inches long, and has an arm 5 inches long extending upward nearly at right angles, with a slot in the end for holding the line when the proper length has been put out. The line not in use remains wound on the handle, which is held in the hand of the fisherman.

Spears, gigs, gaffs, etc.—Various kinds of fish spears are employed in the fisheries. On the Ural fishermen use a three-pronged barbed spear with a long iron handle, having a socket at its upper end for the wooden handle to fit into. They also have a four-pronged barbed spear, with a long wooden handle. Both of these are shown in figures 13, 14, Plate XL.

A four-pronged gig, attached to a long wooden handle, is used for catching fish in certain sections of Russia. Each prong is $2\frac{3}{4}$ inches long (outside handle) and has three or four upright barbed points or hooks. The handle is made of a length suitable to the conditions where it is to be used. The one exhibited had a round spruce handle $1\frac{1}{2}$ inches in diameter. The iron gig was fastened to this by a strong seizing covering the lugs of the prongs for a distance of 3 inches up the handle.

The single-pronged gaff of the Astrakhan region, and especially that used on the Ural (Pl. XL), is similar in general form to the gaff used by American codfishermen. It differs, however, in having a

longer haft, and a thin metal guard which is worked onto the gaff, about abreast of the lower end of the handle and extending more than halfway up the haft. The apparent purpose of this is to protect the seizing around the haft from chafing. The handles of the Ural gaffs are often very long, consisting of several pieces joined together by seizings over the chamfered ends. One form of single-hooked gaff in the Ural region has a short handle, with a projecting limb or hook turned downward at its upper end to prevent the hand from slipping (fig. 12, Pl. XL).

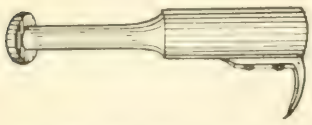


FIG. 169.—Fish gaff. (Drawn by W. H. Abbott.)

Three-pronged gaffs, with very long hafts, are also used on the Ural.

The boat hand gaff used on the fishing canoes (fig. 169) is very much like some of the Scandinavian gaffs. It has a spur-shaped iron gaff, on a short handle, which is heavy and club-shaped at the lower end to serve as a killer, and much smaller and rounder at the upper part, so that it can be grasped easily, while the extreme upper end usually has a knob to prevent the hand from slipping.

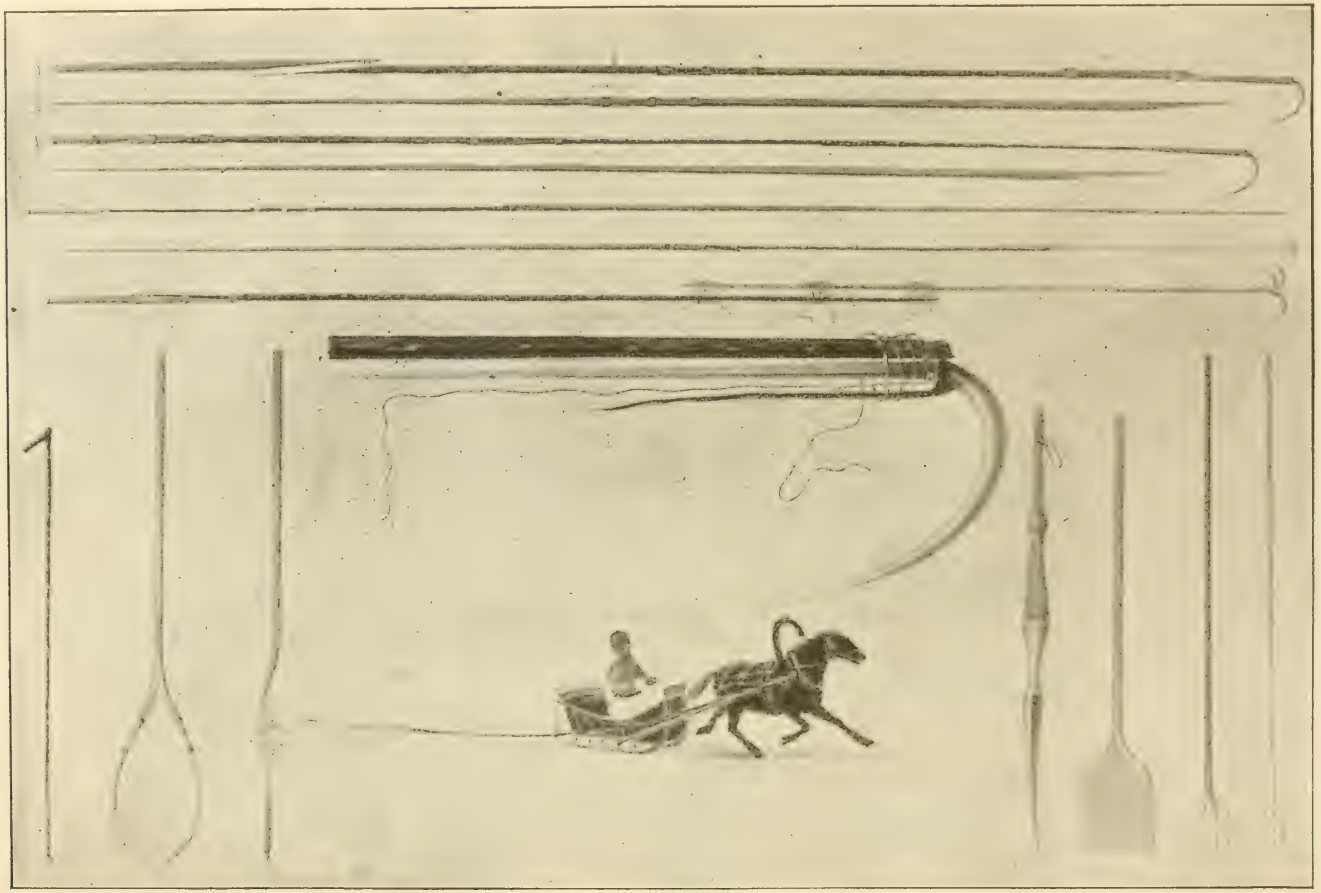
FIG. 170.—Cod gaff. (Drawn by W. H. Abbott.)

FIG. 171.—Fishing apparatus. Net hook, ax, boat hook, ice chisel, and dip net.

The gaff used in the codfishery on the Murman coast (fig. 170) is similar to those of the Norwegians, and consists of a barbless iron hook fastened to a short, heavy handle, which is used to kill the fish as well as a hand grasp for the gaff.

A combined ice pick and gaff (fig. 171), which is substantially the same as an ordinary boat hook, is used in winter for pulling nets under the ice, or for other purposes.

A special kind of gaff (fig. 171) is made for working nets under the ice. This is a round sapling, which is strongly curved and worked down to the proper size. At one end is some sort of hook, and at the other is usually lashed a straight pole to make the implement long enough. This is used in conjunction with another implement of the same form, except that it has a piece of wood across its lower end (fig. 172), which serves to push the nets under the ice, from one hole



URAL RIVER FISHING APPARATUS.

From Russian drawing.

toward another, while a fisherman with the gaff reaches along under the ice to catch the apparatus as it nears the point where he is stationed. This is 8½ feet long. A two-pronged iron implement (fig. 173), with one of the prongs turned back to form a hook or gaff, is used for operating nets under the ice. The wooden handle is 6 feet long, the prongs are 9½ inches long.

Among the gaffs used in the Caspian Sea region is one with a sharp, spur-like prong fastened in a round wooden handle, which may vary from 10 or 15 inches to 4 or 5 feet in length. A short iron gaff, very much like the American halibut gaff, but with a small eye at the top, is used for handling large fish. The upper end and eye are served with line, and a short lanyard with a knot worked on its end is spliced into the eye.

FIG. 172.—Net pusher. (Drawn by W. H. Abbott.)

Two-pronged gaffs, with the prongs strongly curved and bent in toward the same side, are used in the preparation of fishery products.

In operating seines in the waters of the Astrakhan region a special device is used for keeping the foot of the nets down close to the bottom while they are being drawn in. This consists of a stout iron wire bent into a heart shape, and with the two ends fastened to the end of a pole by a strong seizing.

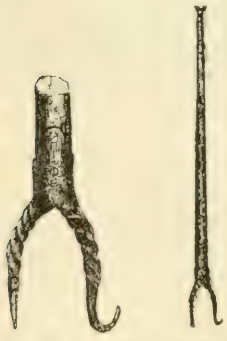


FIG. 173.—Ice fishing implement. (Drawn by W. H. Abbott.)

The ice pick differs very little, and chiefly in the shape of the handle. It is a long, sharp-pointed or sharp-edged chisel (fig. 171), with a socket at the top in which is set a short wooden handle.

A wide-bladed, hatchet-shaped ax (fig. 171) is used in Astrakhan for cutting ice or decapitating sturgeon, but, generally speaking, any kind of ax that may be conveniently handled is utilized for these purposes.

Fish baskets, pots, etc.—A large variety of devices coming under this head were exhibited. They are generally used in connection with barriers across rivers or with leaders.

A most effective form of fish trap or basket is used for catching salmon in northern Russia (fig. 174). It consists of a truncated box-shaped device, square in cross section, some four or five diameters long, and about twice as wide at the mouth as at the opposite end. It has a stout wooden frame and is covered with narrow, thin slats placed about their own width apart. It has a funnel-shaped net entrance, and a net door at the top. This is set at intervals in a slat barrier, built across (or out into) a river, and each end of it rests

between two stout stakes, which are driven into the bottom. Across each pair of stakes, near their tops, are secured poles, on which are laid pieces of boards for the fishermen to stand upon when raising the basket.

Several forms of fish baskets are employed for the capture of lampreys and small fish. One of these is an openwork basket, cylindrical in form, with a square-mouthed, funnel-shaped entrance, the opposite end tapering to a point. Another is built of wooden staves, set closely together and held in place by a line rove through holes near the ends and in the middle. The circular, cone-shaped entrance is built in the same way. This basket is cylindrical, tapering to the rear end, it being about twice the diameter at the entrance that it is at the small end. It is provided with two hoops, and a rope strap by which it can be lifted is attached to these. Near the rear end is a round hole for taking out the catch. This is closed by a wooden valve or door.

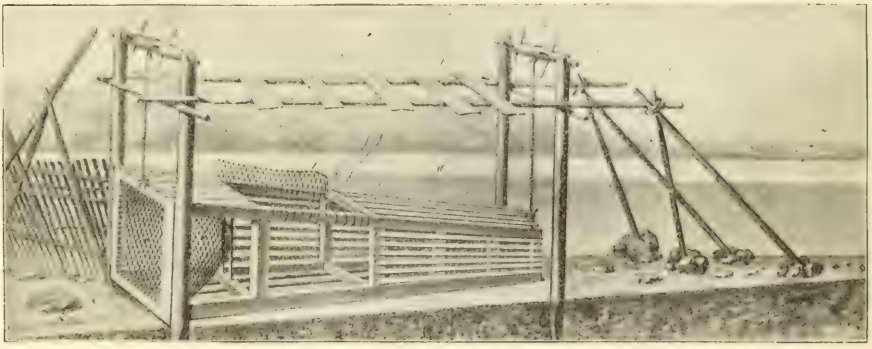


FIG. 174.—Salmon trap. (From Russian publication.)

Both of these devices are used in northern Russia. They are set in openings between brush weirs or barriers, as shown in figure 175.

A small cone-shaped basket (fig. 176), about 2 feet long, made of thin wooden splints, is used for catching lampreys and slime eels (*Myxine glutinosa*). The one figured is 21 inches long and 7 inches diameter at large end.

One of the most common forms of fish basket (fig. 177) is made of wicker, with a cone-shaped entrance, and the opposite end drawn together and tied. These are often of large size, but generally about 4 or 5 feet long. They are set in a weir, or "battery," built in or across a stream, with basket-like fascines (fig. 178), filled with stones, placed side by side, except where the fish baskets are located.

Two forms of fish traps made of reeds or wicker are used in the Caspian Sea region, and especially in the Volga. One of these (fig. 179) is in the form of a cone, with a cone-shaped entrance. The other is like an eel pot, with a very large funnel-shaped entrance. Two

other forms are made of closely woven wickerwork. One of these has a form closely resembling the common sea urchin (fig. 180), with a small entrance at the top. The other is a flat-bottomed circular basket, about as high as wide, and the open top about two-thirds the diameter of the bottom (fig. 181).

Sleds.—It may easily be surmised that the conditions existing in Russia during a large part of the year make necessary the use of sleds for transportation. Various forms of these are shown in Plate XLI, from the Laplander's boat-shaped sledge, open at the rear, to the well-constructed sled with a covered box on it that can be locked.

Fig. 175.—Russian method of setting fish pots or baskets. (From Russian publication.)

Rollers.—The line roller used in the long-line cod fishery on the Murman coast (fig. 182) is unlike anything heretofore described, and is really a combination of two rollers for the purpose of easing friction where there is a current; it is fixed on the gunwale of a boat so that it remains in one position. A wooden roller, recessed in the middle and quite of a conventional form, is arranged to revolve between two iron pins, which are curved just below the roller to form shoulders which rest on top of an oblong piece of plank, through which the pins pass and project some distance below, so that they may enter holes in a boat's gunwale, where the device is placed when in use.

Another and longer roller is attached to the outer edge of the plank, at right angles to the other and abreast of one end of it, so that a line passing over the first roller and trailing to one side by the current will come against the lower one, which revolves when the line is hauled and causes it to lead straight over the other. This lower roller

is held by an iron strap, or arm, which reaches out from the edge of the plank, and, turning at right angles, receives the pintle of the roller in its outer end.

Killicks and grapnels.—Three-pronged and four-pronged iron anchors seem to be in favor with the Russian fishermen who are able to have them. But the anchors mostly used are stone killicks. One of these used on the Murman coast (fig. 183) is peculiar in its construction. Two pieces of flat timber are made to fit together so as to receive and hold a long stone in the center. The planks, when joined, are pointed below, have a horn-like arm worked on each side, and a hole at the top to receive the hawser. The pieces of wood are lashed together at top and bottom.

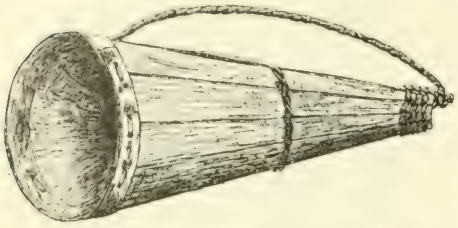


FIG. 176.—Fish trap. (Drawn by W. H. Abbott.)

The stone killick of the Astrakhan region is quite different. Two saplings, each with a stout limb on it at the proper angle, are cut of a suitable length, and the limbs are sharpened in spur-like points. Sometimes a long stone is placed between these (fig. 184), and the sticks are lashed together at top and bottom, so that the projecting limbs will be at right angles to the stone, to hook into the bottom. At other times, however, an elongated, more or less egg-shaped, stone is put upright between the sticks instead of crosswise, and secured in that way (fig. 185). Often it is covered with netting, but I am unable to say for what purpose.

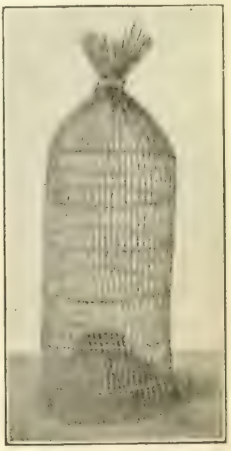


FIG. 177.—Fish basket.

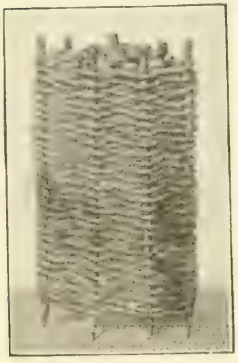
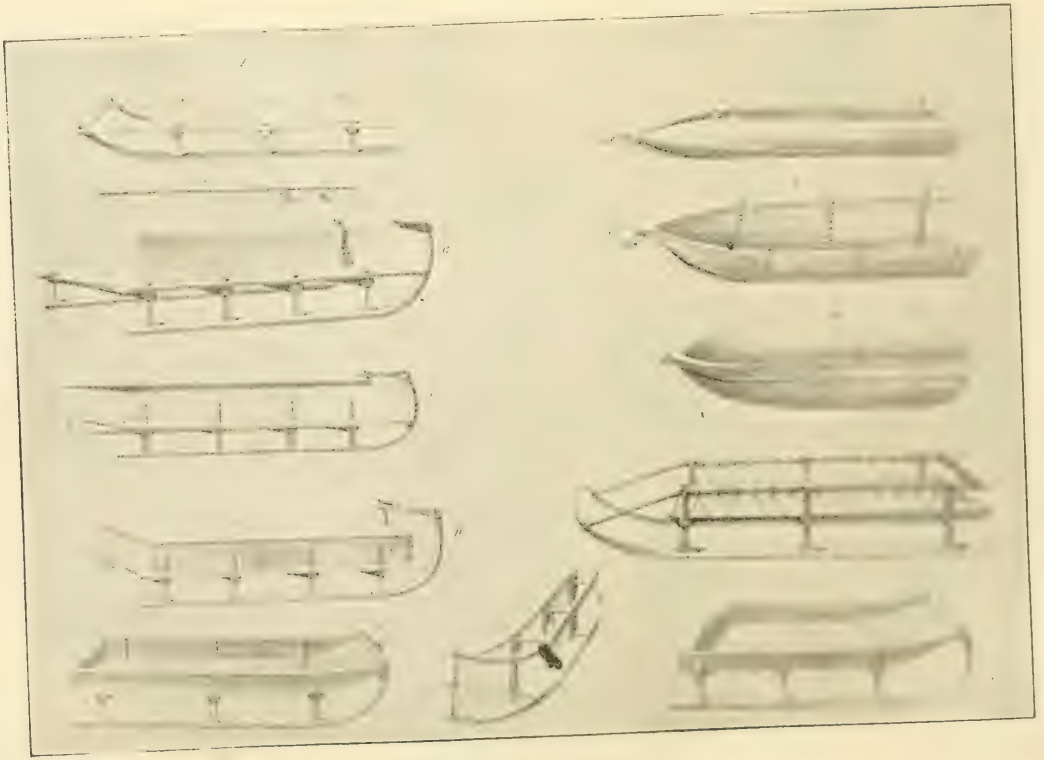


FIG. 178.—Basket fascine.

Knives.—The cod-splitting knife used on the Murman coast (fig. 186) is something like that of the Norwegians, but the blade is longer in proportion, and the handle is different, the part beyond the hand grasp being slightly curved and pointed.

The throater, or ripper (fig. 187), is a sharp-pointed, single-edged knife of a common form, with the back slightly concave near the point, and the cutting edge rather strongly convex. The blade is about 7 or 8 inches long and the wooden handle about 4 inches long.

Another crude form of knife used on the Murman coast is shown in figure 188.



SLEDS AND SLEDGES.

S. Doc. 39——21

The knives used in the preparation of isinglass from the swim bladders of sturgeon have a broad blade and short, round handle of hard-wood, with a ferrule over the end of the handle next the blade.

Fish-hook file.—A machine-made, dagger-shaped, broad-bladed file is used in the Astrakhan region for sharpening hooks. It has a round, hard-wood handle, with ferrule next the blade.

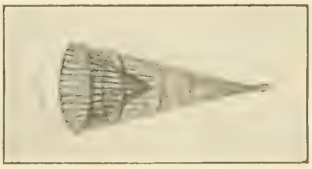


FIG. 179.—Fish basket.

Buoys and bailers.—A very ordinary form of solid wood buoy (fig. 189) is used in the fisheries of the Murman coast.

Another wooden buoy used there is conical in form, with a flat section at the apex, or lower end, having a hole in it for a strap or the buoy rope to bend into, and a staff at the upper end; also on one side a piece of board for a hand grasp. I am informed that glass buoys are now used on the Murman coast.

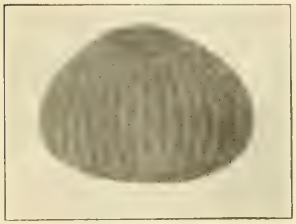


FIG. 180.—Fish trap.

Ordinary round buoys of varying lengths and sizes are used in Astrakhan. But a very common buoy of this region is made of river reeds, which are cut with a long sickle and dried by the fishermen. These are bound together in bundles of different sizes, and serve very well for buoys if not kept too long in the water. Mention has already been made of the use of gourds for buoys. Sometimes a buoy is simply a section of timber sawed off to the requisite length.

The scoop bailers are made by the fishermen, and are serviceable and enduring. The larger one (fig. 190) is 19½ inches long, 6 inches wide, and 7 inches deep; handle, 20¼ inches long. The smaller one (fig. 191), similar in shape and size to Alaskan scoops, is 14½ inches long, including handle, 6¾ inches wide, and 2¾ inches deep.

FIG. 181.—Fish trap.

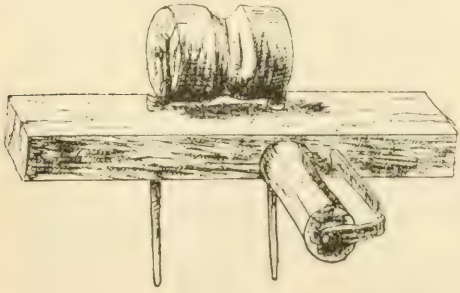


FIG. 182.—Line roller. (Drawn by W. H. Abbott.)

Live cars.—Various forms of live cars are used in northern Russia, some of which are illustrated. One form consists of a sharpened, flat-bottomed, boat-like form, built of wood, with perforated sides and bottom, and with the deck arranged to open one-half at

a time, placed somewhat below the upper edge. A live car of this style is easily towed at the stern of a boat.

Another kind of live car is nearly a cube in shape, made in a basket-like form by being woven together. It has an opening on top. A cylindrical-shaped live car, made of netting stretched over a framework, with a hole at one end, is considerably in favor. It is light and convenient and serves the purpose of keeping small fish alive very well. Another live car, made of netting stretched over a framework, is square at one end, of a pyramidal form, tapering to a point at the end. The larger end has a projecting nozzle of netting into which the fish can be put. These various forms are shown on figure 192.

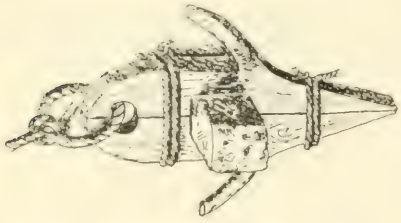


FIG. 183.—Stone killick. (Drawn by W. H. Abbott.)

Astrakhan live car.—A large, boat-shaped live car (fig. 193) is used in the Astrakhan region for collecting fish on the fishing grounds and taking them to the curing stations. This is often 60 to 80 feet long and fully 20 feet wide. It is sharp at each end and has a flat bottom. The entire hold is divided into sections by open bulkhead of vertical planks, separated 1 or 2 inches from each other and supported at the top by stout cross beams. This car is towed to the point where fishing is carried on and is anchored there until its cargo is completed, when it is towed back.

FIG. 184.—Astrakhan killick. (Drawn by W. H. Abbott.)

FIG. 185.—Astrakhan killick.

Sturgeon testing needle.—The Russian fishermen use a special form of probing needle for determining if sturgeon have roe suitable for caviare. The test is made on live fish as soon as they are taken from the water. An improved form of needle has recently been devised. This is shown in figure 194. The improvement consists in

FIG. 186.—Cod-splitting knife. (Drawn by W. H. Abbott.)

FIG. 187.—Cod throater. (Drawn by W. H. Abbott.)

a better design of the open groove (fig. 195) for extracting the eggs than was in the old-fashioned needle.

When a sturgeon is taken from the water, this device is quickly thrust into its side at one or more points, and when withdrawn it

brings with it some of the eggs, if there be any. The appearance of these enables the experienced fishermen to decide at a glance whether or not the fish has roe that will make caviare.

This probing needle is a sharp-pointed steel tube, opened into a groove near the point in a manner suitable to accomplish its purpose, as shown in the illustration. It is fixed in a short machine-made handle. It is 11⅛ inches long outside the handle, and $\frac{3}{16}$ of an inch in diameter at the widest part of the groove, which is 3⅜ inches long. Below the groove the needle tapers to a sharp point. The handle is 2 inches long.

FIG. 188.—Fish knife. (Drawn by W. H. Abbott.)

FIG. 189.—Buoy. (Drawn by W. H. Abbott.)

Stringing needle.—A needle 14½ inches long and $\frac{3}{16}$ of an inch in diameter is used for stringing fish in bundles. It is threaded with coarse twine, upon which the fish are strung.

Fishermen's apparel, etc.—Soft, thick leather garments are used by the Russian fishermen instead of oil or rubber clothing, which appear to be unknown, or at least they are not worn. A suit of waterproof clothing consists of a heavy pair of trousers, made long enough to cover the feet, and without opening at the bottom of the legs, which serve the purpose of boots, and a short leather jacket coming down to the hips. Leather mittens are worn, and also crudely made low leather sandals (Pl. XLII). The latter are made of one piece of leather crimped into shape and the top held in form by a lacing running through holes near the edge. It is interesting to note that these primitive shoes are similar to sandals worn by the Danes, samples of which were exhibited in the Danish section. Long, heavy boots are also worn by Russian fishermen.

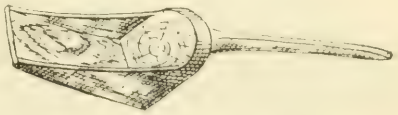


FIG. 190.—Bailer. (Drawn by W. H. Abbott.)

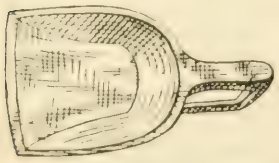


FIG. 191.—Scoop. (Drawn by W. H. Abbott.)

When working on the ice the Astrakhan fishermen wear iron or steel corks (Pl. XLII) strapped on their feet. These consist of an open circular plate that fits underneath the boot, and having a chisel-pointed cork on each side.

Among the personal equipment of a seine fisherman may perhaps be included the hauling strap shown in Plate XLII, an implement in almost universal use in the Astrakhan region for pulling drag seines to the shore. It consists of a wide strap of plaited hemp marline or spun

yarn, long enough to cover a fisherman's shoulders, and extends a short distance behind. It is finished at each end with three eyed

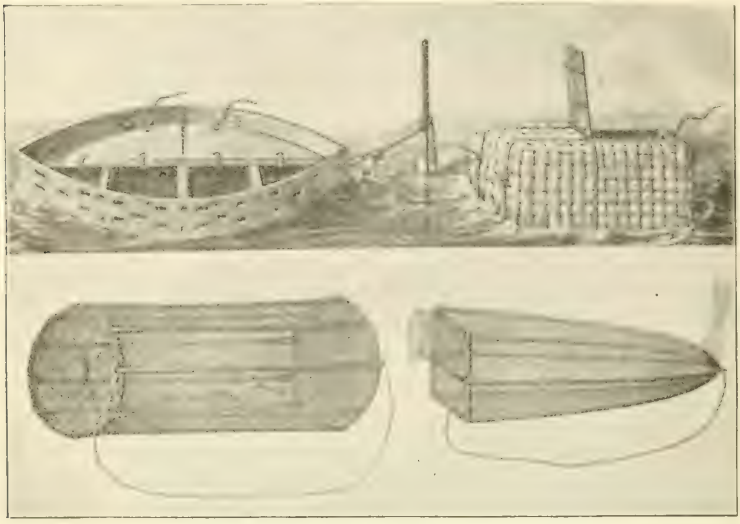


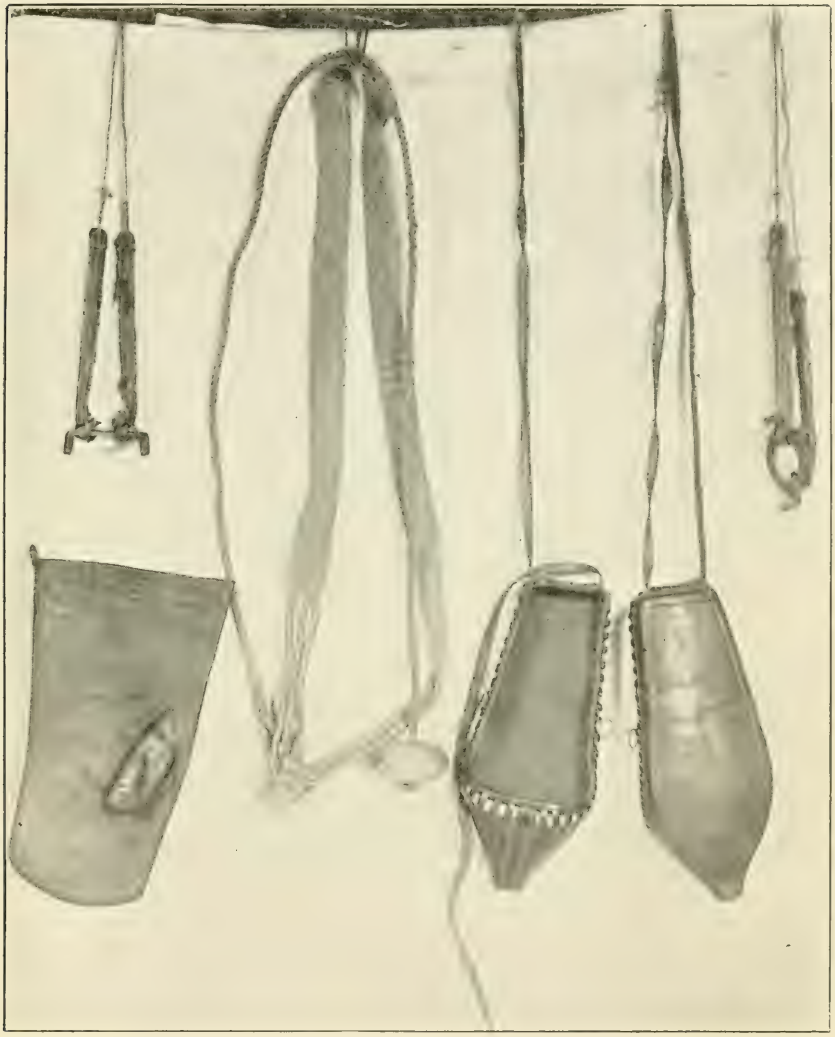
FIG. 192.—Live cars and nets. (From Russian publication.)

lanyards, into which is spliced a small hemp rope about 4 feet long. The lower end of this rope passes through a hole in the center of a round piece of hard wood, shaped like a door knob, and is knotted to hold the knob from slipping off.

FIG. 193.—Live car, etc.

When hauling a seine, the fisherman puts the strap over his shoulders, hitches the end of the rope to the cork rope of the net—the knob makes this easy—and then bends forward, so that he can pull with all his strength.

Apparatus used in preparation.—A large variety of implements are used in the preparation of fishery products in Russia, of which a few have already been described. These were numerously represented in the collections exhibited.



OBJECTS USED BY ASTRAKHAN FISHERMEN.

Leather mitten, pair of leather shoes (showing upper and lower sides), strap used for hauling seine, and ice corks to prevent slipping.

Handbarrow.—The Astrakhan handbarrow (fig. 196) consists of two poles, tapering at each end, attached to two oblong or half-round pieces of plank (by passing through holes in their upper corners, or otherwise), and in the space between the planks and the poles a stout sack of netting, in the shape of a half cylinder.

FIG. 194.—Sturgeon testing needle. (Drawn by W. H. Abbott.)

Wheelbarrows.—The Astrakhan wheelbarrow (fig. 197) has long open spaces in its bottom, while the sides are made of strong netting fastened to the frame. The chief peculiarity is the movable end over the wheel, which is held shut by a bar, the notch on which catches on the top of the rear frame. The object of this door is to be able to dump the load of fish out of it. This is done by lifting the rear end of the stick and then lifting on the handles of the barrow until the latter is raised to the proper angle to effect the object.

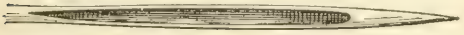


FIG. 195.—Point of sturgeon needle. (Drawn by W. H. Abbott.)

The body of the barrow has a slight flare. The following are the inside dimensions of the body at the top: Length, 2 feet 10½ inches; width of rear end, 2 feet 3½ inches; width of front end, 17½ inches; length of handles, 2 feet 2½ inches.

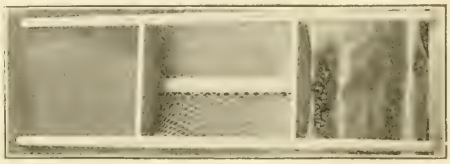


FIG. 196.—Handbarrow.

Fish wagon.—A common form of fish wagon has a body with flaring sides, mounted on two pairs of wheels—a plain box-like affair made of planks, but strong and serviceable.

Measuring sticks.—In Astrakhan most species of fish are culled by length, and measuring sticks specially made for the purpose are used to determine the length. Seven sizes of these are used, of which four sizes were exhibited. Of the latter, one was for fish 9⅜ inches long and upwards; one for fish 12¼ inches long; one for fish 14 inches long; and one for fish 21 inches long.

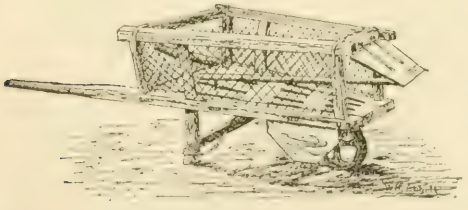


FIG. 197.—Wheelbarrow. (Drawn by W. H. Abbott.)

The stick is simply a piece of thin board (fig. 198) with a handle at one end, and the measuring part made narrower and straight on both edges, except at the end, when the back is, perhaps, tapered somewhat.

Salt shovel.—A broad-bladed wooden shovel (fig. 199) with short round handle is in favor for handling salt in the process of salting fish. The one exhibited was made of oak, and the blade or scoop part was curved slightly. The blade was 9½ inches long and 8¾ inches wide; handle, 5 inches long.

FIG. 198.—Measuring stick.

Barrels.—The barrels ordinarily used for packing fish in Russia have a much greater diameter in proportion to their height, and a greater capacity than the fish barrel of western Europe and America.

They are well and strongly made; usually with five to seven stout wooden hoops at each end, but with no bilge hoops. Sometimes a barrel of the conventional form, with chime and quarter hoops, is used, but such seem to be exceptional.

Soaking tub.—An iron-hooped cylindrical tub, smaller at top than bottom, is used for soaking fish bladders, and especially those of sturgeon, to prepare them for cleaning.

Salt tub.—A metal-bound tub, with metal handles on its sides, is used in Astrakhan for keeping the salt in that is intended for curing caviare. This tub (fig. 200) is high and is much wider at top than at the bottom.

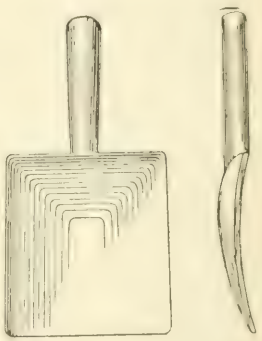


FIG. 199.—Salt shovel. (Drawn by W. H. Abbott.)

Caviare tubs.—Small tubs of various patterns are used in the preparation of caviare. Some of these are low. Both metal and wooden hoops are used in their construction.

Fish-cleaning box.—In the preparation of fishery products use is made of a plain, shallow, wooden box (fig. 201) of varying dimensions, for washing and cleaning the fish before they are salted. This is usually nearly square, has slightly flaring sides, and a hole at one corner for letting off the water. This is closed with a plug that is long enough to come above the rim of the box.

FIG. 200.—Salt tub.

Draining board.—This is a low, oblong, open platform (fig. 202), made of boards with spaces between, and higher at one end than the other, so that any water which does not pass through the openings will drain off the lower end, which is only 3 or 4 inches high. It is used for draining fish after they have been washed; hence its name.

Pickling trough.—A long trough-like receptacle made of planks is

built for salting the dorsal part of large sturgeons in, to make the cured product known as "balki." This may vary in size, and it has no special features that need be described at length.

Kettles.—Various forms of kettles are utilized in the preparation of fishery products, more especially in trying out oil, etc. Some of these are the ordinary legless, round-bottomed, iron pots common to all countries. These are enlarged in some cases by having an iron-hooped bottomless tub fitted to the top to increase the height.

FIG. 201.—Fish-cleaning box.

A cylindrical flat-bottomed copper kettle (fig. 203), tinned inside, is in favor in the Astrakhan region, as a receiver of fat or fish oils. It is provided with short legs, and also has ears for lifting it.

Blubber scraper.—For removing the blubber from the interior of kettles, when oil is being tried out, and thus preventing it from burning and injuring the oil, use is made of a straight-edged, chisel-shaped scraper, into the socket of which is fitted a wooden handle 3 or 4 feet long. A similar implement is used in New England.

FIG. 202.—Draining board.

Caviare apparatus.—Aside from those already referred to, there are a number of implements used in the preparation of caviare, which is a large industry, and is prosecuted with such success that a description of the apparatus employed may prove instructive and useful to American fishermen and packers.

At the mouth of the Volga a large wooden trough (fig. 204) is used for receiving the sturgeon eggs from the first sifting, and a sieve of suitable dimensions to fit its top is provided. Ordinarily, however, tubs are preferred for this purpose, and a smaller sieve is used for the second sifting, of a size to fit over the top of the receptacle.

A common form of sieve is square, and is fastened inside of a square wooden frame.

A small circular sieve with quite a deep frame is used for dipping the caviare from the lye into which it is first put.

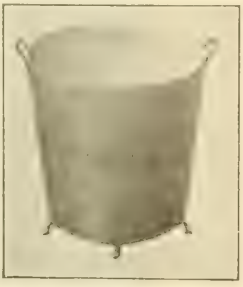


FIG. 203.—Oil kettle.

A wooden fork, which resembles a large comb, with a handle on top (fig. 205), is a favorite implement for handling caviare when it is being salted. It is 11¼ inches long and 4¼ inches wide, teeth ½ inch apart; a smaller fork has 8 teeth ¼ inch apart.

Several forms of presses for pressing caviare were exhibited. One

of these is shown in figure 206. It consists of a plank bottom, wide enough at one end to suit the package, and narrow at the other. On

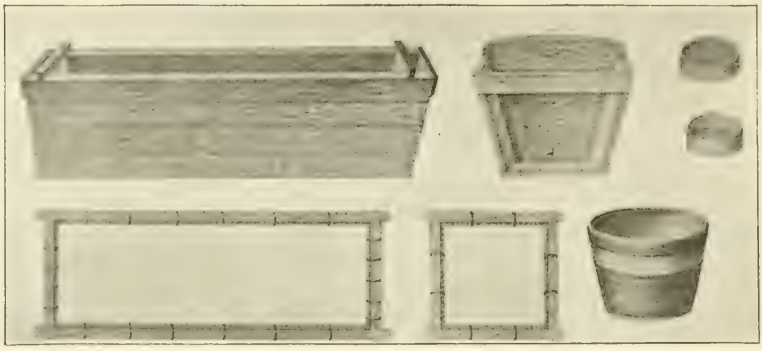


FIG. 204.—Caviare tubs and sieves. (From Russian drawing.)

the wide end are erected two upright pieces of plank 12½ inches high, and these are securely fastened to serve as guides. An iron lever is arranged to operate a plank press, 12½ by 7 inches, that works between the uprights, and by exerting power on the handle of the lever the caviare is pressed into the receptacle. This press is 4 feet 4 inches long.

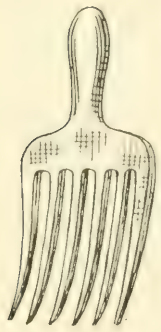


FIG. 205.—Caviare fork. (Drawn by W. H. Abbott.)

Another and simpler form is shown in figure 207. In this the uprights are placed very much as on the press first described, though they are supported by knees. A wooden lever is used, however. This is put under a rope strap, and a lanyard, which reeves through a ring on each side of the rear end of the bottom plank, serves to bring the gradual strain required to press the caviare. Hard-wood blocks, with handles on them, are used for piling upon the sacks containing the caviare, in order to secure additional pressure as the product is brought into a smaller compass.

FIG. 206.—Caviare press.

Barrel marker. For marking on fish barrels the weight, etc., of their

contents a conventional form of lumber marker (fig. 208) is generally used. This is so well known that no special description seems necessary, the interesting feature about its utilization being that it seems to

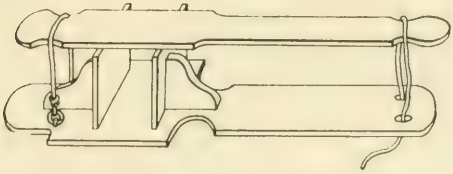


FIG. 207.—Caviare press. (Drawn by W. H. Abbott.)

FIG. 208.—Barrel marker.

be preferred to branding irons or stencils, which elsewhere are commonly considered better for this purpose.

Pickle pump. Among the most useful devices exhibited by Russia was a hand pump with hose, etc., attached, used for forcing pickle into barrels filled with fish. This is shown in figure 209. It consists of an ordinary form of force pump mounted on a wooden horse or stand. It has a wooden lever handle, and is provided with a corru-

FIG. 209.—Pickle pump.

gated rubber suction hose underneath, with a strainer at its lower end. It has a canvas discharge hose, fitted at the end with a metal spout for entering a hole in the head or side of a cask, and with a simple form

of stopcock to shut off the flow of brine when the barrel is full. Fish are packed dry, as in this country, and are pressed tightly into the casks; the barrels are then headed, and the pickle is subsequently pumped into them. This seems to be a decided improvement on the system of pickling fish in barrels in the United States, where, as a rule, only a simple funnel is used, into which the brine is poured until a cask is supposed to be full. It is far within the possibilities that sufficient pickle is not always put on by the method referred to, and much of the loss of pickled fish, which is now no small factor in the American fish trade, doubtless might be prevented by the use of a pump for forcing brine into the barrels, especially if the latter are constructed on modern ideas.

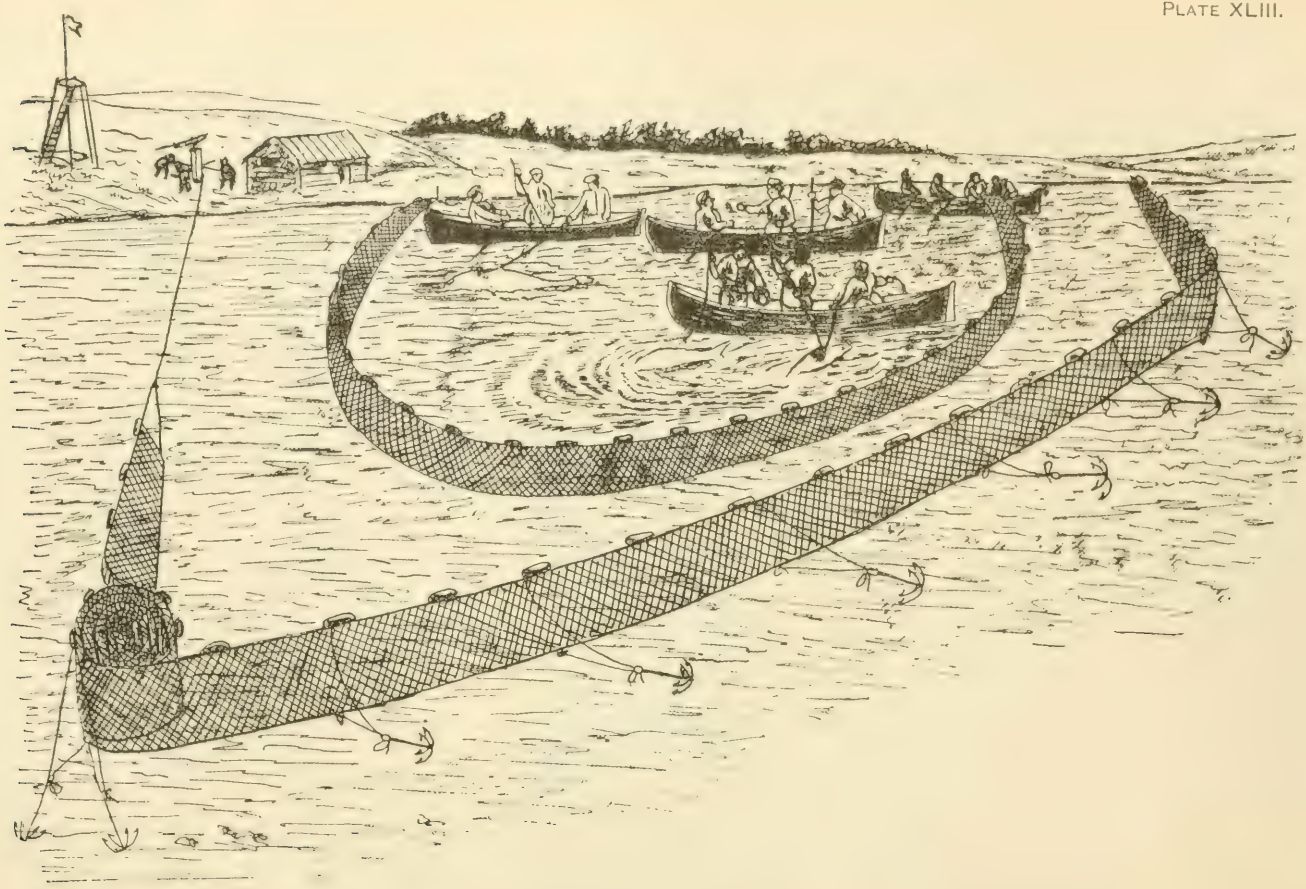
Cordage.—It is scarcely necessary to make more than a passing allusion to the fine exhibit of hemp rope displayed by T. Hoth, of St. Petersburg, since the excellent quality of Russian hemp cordage is universally understood and appreciated. It may, however, not be amiss to mention the fact that the collection displayed by this firm embraced many varieties of products, from oakum, through various sizes and grades of hemp cordage—both rope and cable laid, light and heavy tarred, etc.—to a mammoth cable.

Methods of fishing.—The methods of fishing practiced in various sections of European Russia were fully illustrated by photographs. Some of these methods have been indicated sufficiently in the descriptions and illustrations of fishing apparatus.

White-whale fishery.—In prosecuting the fishery for white whales in the White Sea region a large seine is run out from the coast nearly half its length, and is anchored in position where the whales are expected to come along the shore, as is their habit during fine weather in summer, when large schools of them approach the shallow shores or run between the islands that dot the White Sea. The net is curved a little at its outer end, and nearly one-half of the seine is rolled up and tentatively tied with light strings (Pl. XLIII). All is secured by anchors in this way, and a warp is carried from the outer end of the seine to the shore. The fishermen then watch for the arrival of a school of belugas, and when the whales are seen coming along the coast men stand ready for work on shore, while others go out in boats to turn the approaching cetaceans shoreward, if they show a tendency to go too far out so as not to be within reach of the net.

As soon as the school passes inside the arm of the seine the men on shore pull on the line, break the cords that hold the end of the net, and speedily drag it to the shore, behind the whales, thus cutting off their escape. Another seine is then run inside the anchored one, and the whales are gradually pulled to the beach or into shallow water, where they are promptly dispatched.

Fishing begins at the end of June, and the fishermen organize into



SEINING WHITE WHALES.

Drawn by W. H. Abbott, after Russian print.

companies. Each company generally has eight boats. There are about 40 men in the company.

In describing this fishery Schultz says:

The fishermen cast anchor near a group of islands and wait patiently for the watchmen to give the signal that a flock of orcæ (white whales) is approaching. As soon as the signal is given they row rapidly toward the place designated, taking good care, however, not to fish in deeper water than 5 "segenes" (35 feet), lest the net, which is only 6 "segenes" (42 feet) deep, as has been said before, should prove useless.

At first the boats row without order, but as soon as they approach the orcæ they place themselves in the following manner: The two middle boats approach each other and remain in the rear, while the others advance to the right and left, keeping at a distance of 120 "segenes" (840 feet) from each other, i. e., almost the length of the seine. In order that the fishing should be successful it is necessary that the boats should advance, remaining always two and two, at the same depth; afterwards they must halt at some distance from the orcæ and cast all the nets at the same time, after having tied them to each other. In this manner the orcæ are surrounded, and endeavor in vain to break through. The circle is constantly growing narrower, and the orcæ are finally harpooned with fish ; 'gs having short handles, which are easily

FIG. 210.—Seal fishing village.

detached. The iron of the fish gig is not beyond the fisherman's control, as it is joined to the hand by a cord used for pulling up the instrument and the pierced orca.

If the orcæ enter into a small bay their retreat is cut off by means of large stationary seines, and they are easily captured.[1]

Seal hunting.—Reference has already been made to the methods of hunting seals in the White Sea region and the Caspian Sea. On what is known as the "winter coast"—the eastern coast—of the White Sea, and in the Bay of Mezene and the Gulf of Dwina the Greenland seal (*Phoca gröenlandica*) is vigorously hunted. Large villages of seal-hunters' huts are on most parts of these coasts. One of these is illustrated in figure 210.

The huntsmen carefully observe from the coast the movement of the floating ice. High, wooden towers are erected for this purpose all along the shore, whence the observers watch the horizon with telescopes, and when they have discovered an encampment of the phocæ they decide whether it is possible to get to them, and whether it is worth while to give them chase. Small hunting sheds are also built along the coast, each of which can accommodate as many as twenty huntsmen.

[1]Account of the Fisheries and Seal Hunting in the White Sea, the Arctic Ocean, and the Caspian Sea, by Alexander Schultz, pp. 55–56.

As soon as the phocæ show themselves at a short distance from the shore the huntsmen venture on the floating ice, drawing a small boat after them, and they kill the young phocæ by blows with their boat hooks and the old ones by gunshots. In order to approach the phocæ as near as possible the hunters make use of the following ruse: They make themselves, as it were, invisible by muffling up in long and large white shirts, and by advancing slowly and noiselessly on the snow. When the chase is over the dead animals are at once skinned and dragged on shore. They usually kill only those which they can take with them, for the wind easily drives the ice far away and the booty would be lost to the huntsmen, who themselves are often exposed to the greatest dangers.

This chase takes place on the "winter coast," extending over a space of 400 versts (230 miles), and numerous huntsmen meet there from the districts of Archangel, Penega, and Mezene. The principal place of meeting, and at which generally 2,000 huntsmen assemble, is called Kedy, and is located 12 versts (about 7 miles) from Cape Voronov. The huntsmen have built at this place about 100 huts, where there is constant excitement from February till the end of March, while during the rest of the year these huts are deserted.

About the middle of March the young phocæ are large enough to leave the ice and swim toward the open sea, whither the old ones do not follow them. They assemble in the Gulf of Mezene, where they rest on the ice and pair. The pieces of ice in the gulf are sheltered from the wind and are not carried about by the waves, although they melt a little, especially during the rainy periods.

Numerous societies of huntsmen assemble in the beginning of April at the mouth of the river Kouloi, in order to follow for several weeks the chase of the phocæ on the ice. They use sailing vessels 22 feet long with an iron-plated bottom. Every vessel is manned by seven huntsmen, is completely equipped, and furnished with provisions and fuel.

The huntsmen all leave the shore at the same time, and, having reached the floating ice, they draw their vessels on the ice and there establish a vast encampment. The younger and more active huntsmen are sent out to reconnoiter. Provided with snowshoes, they hasten in all directions to search for phocæ. As they observe a flock, they advise the huntsmen of the fact, and these all run toward the spot, drawing their boats after them. Having arrived within gunshot distance, the most expert are placed in the front rank and commence the chase; for every shot must kill, and not merely wound, lest the cries of the wounded phocæ frighten the whole flock and make them speed away. The animals which are killed are then placed in the boats, and the huntsmen return to the shore—sometimes on the ice, sometimes on the open sea—to deposit there the result of the chase, and bring new provisions to the comrades who had been left there.[1]

On the so-called "Terski coast" (western shore of the White Sea) the principal point of assemblage for hunters is at Deviataya, about 9 miles north of Ponoi River.

Huts are built here, and about 500 huntsmen assemble, who form themselves into societies. Every society is composed of a master and three huntsmen. While one of the members of the society remains on shore with his sleigh and his reindeer, the other three venture on the pieces of ice to discover the phocæ which are sleeping there. Every huntsman wears over his clothes a short cloak of reindeer skin, called "sovik," and has on his feet large boots lined with fur. At the end of a long strap passed over his shoulder he draws a small boat, weighing 20 kilograms. A game bag with provisions is attached to his belt. His gun on his shoulder, and having in his hand

[1]Account of the Fisheries and Seal Hunting in the White Sea, the Arctic Ocean, and the Caspian Sea, by Alexander Schultz, pp. 53–54.

a long stick with an iron point, he rapidly and skillfully advances, by means of his snowshoes, over the vast fields of snow and ice. The hunter who leads directs his course by a mariner's compass, and with his iron-pointed stick constantly tries the firmness of the ice. He acts as guide, and his two comrades follow him in single file, drawing their boat after them. When they have arrived at an expanse of water where phocæ are swimming, two of the huntsmen fire, while the third pushes the boat into the water in order to take up the dead animals, which he hoists into the boat by means of a boat-hook.

The chase commences early in the morning, and the huntsmen do not return to their hut till evening, a flag hoisted on the shore indicating to them its position.

The seals of the Caspian are caught with nets as well as killed with clubs and guns. They are hunted chiefly on certain islands where they congregate at fixed seasons.

In the spring and autumn the seals seek the shore to rest in the sun, one herd arriving after the other. Scarcely has the first settled when a second comes, yelling and showing their teeth to drive it away, followed soon by a third, to which it in turn has to yield its place; so that the last herd arriving always drives the first farther back on the coast. The invasion terminates by the arrival of some isolated stragglers.

Now is the time for the hunters to commence the chase. They carefully observe in what place and, approximately, in what numbers the seals have gathered; and then elect as their chief the most experienced and skillful among them. They approach the rookery in boats, either at dusk or during the night, always going against the wind to conceal their approach.

After their arrival on shore the hunters disembark noiselessly, form a line in order to cut off the retreat of the seals, and thus, creeping, advance quite near to the herd, which is sleeping and suspects no danger. On a signal from the chief the hunters all rise at once and pitilessly attack their unfortunate victims, killing them by a single blow on the snout with a club. The bodies are piled up by means of gaffs, and after a few minutes form a rampart, depriving the survivors of every chance of regaining the sea. The seals growl, groan, bite, and defend themselves; but the hunters, eager for gain, go on killing them without mercy, and soon the whole herd is massacred. It is no infrequent occurrence to see 15,000 dead seals cover the battle-field of a single night.

After the killing, the dressing of the seals commences, usually about daybreak.

The head is cut off, the belly is opened, and the skin is taken off with a thick layer of fat adhering to it. These skins are piled up on the boats, which take them to large sailing vessels anchored some "versts" from the shore, on which they are heaped up, each layer being covered with salt. These vessels sail with their cargo to Astrakhan, while the hunters return to the coast to carefully clean the battlefield. They bury the bodies and entrails at some distance, deep in the ground, or throw them into the sea, far from the shore, and carefully obliterate every trace of blood, so that when another herd of seals arrives these animals do not see any marks of the slaughter which has taken place; for experience has shown that they never select for their rookery a place from which every trace of the slaughter has not been carefully removed.

Another way of hunting the seals is to take them with nets. Immense nets are stretched out, into which the hunters endeavor to chase them by yelling and making a noise. This way of hunting is chiefly employed in the maritime district of the Ural Cossacks and in the Gulf of Sineye Mortso, from October till the sea is covered with ice. The nets, called "okhani," are 6 "sagenes" (42 feet) deep, and have meshes of 7½ inches.

The following is the manner of proceeding: Forty boats join together and elect a

chief and an assistant chief. Then the boats sail out to sea with a fair wind, or use their oars, going in a line, thus forming a sort of chain. In every boat there are three nets. The chief, followed by twenty boats, is on the lookout for a herd of seals, which he endeavors to cut off, while his assistant remains with the other half of the fleet at some distance from the shore. When the chief thinks that the time for action has come, he gives the signal by throwing into the sea a bale to which a flag is fastened. At this signal the boats simultaneously cast their nets, which are all tied together so as to form a wall of meshes, by which the seals are soon completely surrounded. Then the hunters begin to yell and to strike the water with their oars in order to frighten them. They seek to avoid the danger by plunging, but they rush against the barrier of nets and are caught in the meshes, so that they can be killed without difficulty. This way of hunting is prohibited in those parts of the sea where it injures the fishing or obstructs the first-mentioned manner of hunting. The chase on the ice is fraught with many dangers, and is, therefore, at present prohibited. The hunters, sitting on little sledges drawn by strong and hardy horses, and provided with food, continue on for several weeks to shoot old seals and kill young ones while they still have their white and silk-like fur. These hunters brave all dangers, and it has sometimes happened that the south and southwest wind, having detached large masses of ice from the shore, has driven them out into the open sea, where they have floated in all directions, with the adventurous huntsmen on them. These unfortunate hunters usually perish from cold and hunger on these masses of ice, or find their death in the waves.[1]

Codfishery. The methods pursued in the capture of cod and halibut, on the Murman coast, differ in no essential particular from those of the Norwegians on contiguous fishing grounds. This fishery is carried on chiefly with trawl lines, which are set and hauled in the ordinary manner.

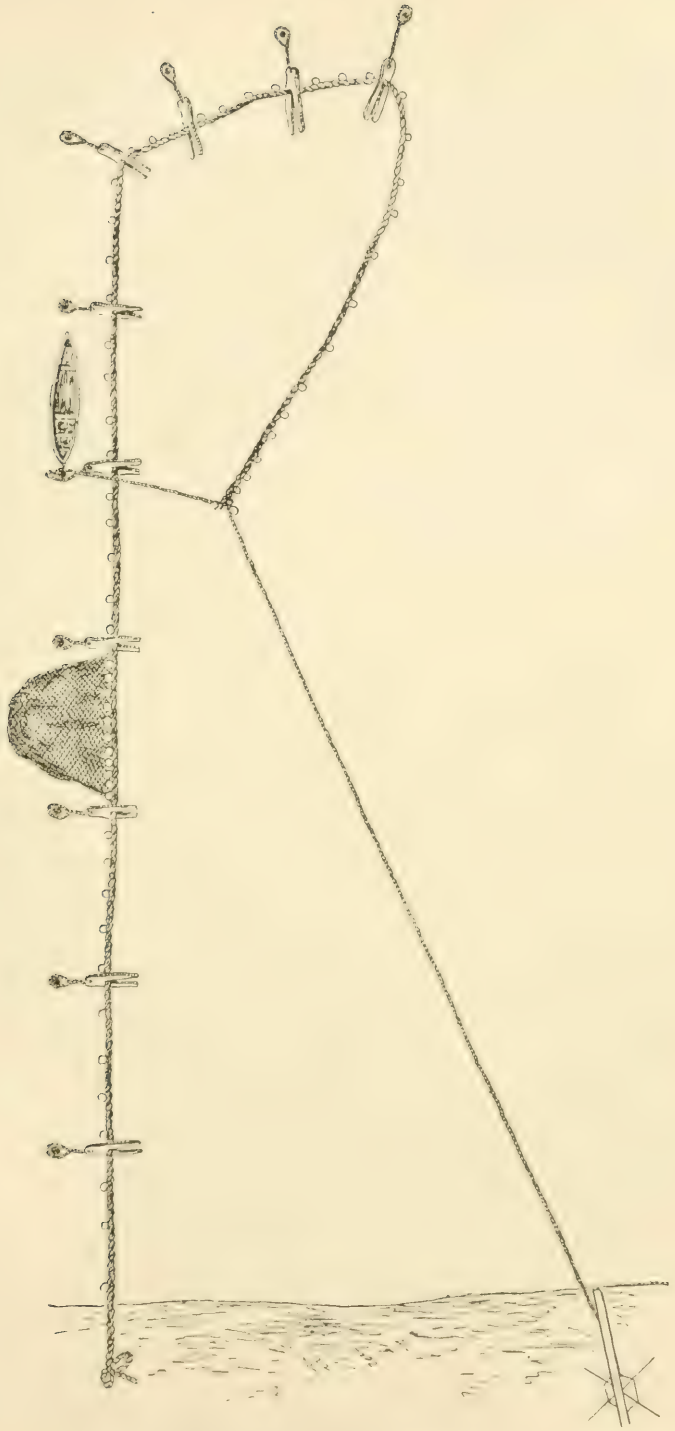
Salmon fishing in northern Russia.—In the rivers of northern Russia various methods of catching salmon are employed, some of them of such a nature as to suggest the probability of the entire destruction of the species in certain localities.

On the river Kitcha, for instance, a barricade is made of slats tied together and driven into the bottom, and supported by braces poles placed in the river at sharp angles so as to steady and make stronger the closely built fence. In the latter is one rather narrow opening in the middle for the free passage of fish. The barricade is so built, however, that each side recurves, the outer portion sweeping down the river in a long curve, while the end next the shore also turns in the same direction. Thus any salmon ascending the river and coming in contact with the obstruction naturally swim upstream, and are led to an opening in the barrier. Passing through this, they enter into a wooden trap from which there is no escape.

At certain times this trap is raised by rude windlasses at either end, a net door that covers a portion of the top is opened, and the fish are removed.

The trap referred to is nearly oblong in shape, somewhat smaller, how-

[1]Account of the Fisheries and Seal Hunting in the White Sea, the Arctic Ocean, and the Caspian Sea, by Alexander Schultz, pp. 93–95.



METHOD OF SETTING SALMON NET.

Drawn by W. H. Abbott, after Russian plan.

ever, at its extremity than at the entrance. Various other forms of traps are used for the same purpose, mostly having a pyramidal form, although some are like one kind of crawfish net employed in Finland. In these forms netting is drawn over a wooden framework, and the larger end is provided with a funnel-shaped entrance of netting similar to that common to lobster nets, fykes, etc.

On the river Ponoi a weir with a sort of heart-shaped entrance is used, and as this is placed so as to intercept the salmon in their journey up river, it must prove very effective.

A formidable barrier extends across the Onega River, having only a narrow opening for the free passage of salmon. On each side of this are numerous openings which lead into fyke-net traps. These fykes have eight or nine hoops and two funnels, and are suited for the capture of numbers of fish at a time.

Where the conditions are favorable, long rows of stake nets are set for salmon, as at the estuary of the Petchora. Here at high tide the nets are submerged, or at least their upper edges are only level with the water; but when the tide ebbs, a large portion of the shore end of the nets is left dry, so that the fishermen can go out on the uncovered bottom and take the fish out. The nets farther out, however, extending beyond low-water mark, must be attended to with a boat.

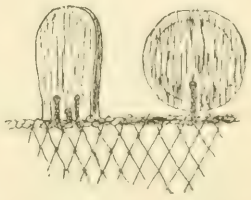


FIG. 211.—Net floats. (Drawn by W. H. Abbott.)

Along the shores of the White Sea salmon are caught in a very peculiar manner—one that I have not noticed elsewhere. The apparatus used is a drag seine, with a bag in the bunt, where the floats are much nearer together than elsewhere (Pl. XLIV). The bag is about one-third the length of the net from the shore end. The net itself is supported by the usual circular and ovate-oblong wooden floats (fig. 211), and has stone sinkers, the latter having holes drilled in them, through which a cord passes to fasten them to the foot rope of the net.

For setting this net a number of stakes—usually eleven—are driven into the bottom from the shore line outward, and then nearly at right angles. The inner end of the net is attached to a bridle, and this in turn to the inner stake. The net is stretched along the stakes and is held to them by stout wooden split clutches or pins, resembling ordinary clothespins. At one end of each pin is a rope loop, which is put over the stake, and the split end of the clutch is jammed onto the head rope in such a manner that it is sufficient to hold the net in place, while at the same time the latter can be pulled clear by a vigorous jerk or heavy strain (fig. 212).

The extreme outer end of the net is loose or unattached to stakes; but this is drawn back toward the leader by a rope fastened to the

upper corner and held in that position by a man in a boat on the outside of the leader. This arrangement brings the outer section of the net into a sort of triangular form, thus, in a way, taking the shape of a fish trap.

But it is the purpose of the seine to serve as a trap only in the most limited sense, for a line leads from a bridle attached to the outer end of the net to a rude capstan on the beach, and as soon as salmon are observed by the man in the boat to be entering the semi-inclosure, he informs the fishermen on shore, who immediately jump to the work of heaving in the line for the purpose of bringing the end of the seine to the shore (fig. 213). As the strain on the rope increases, the clutches or pins loose their hold, one by one, on the head rope of the net, and soon the outer end is landed, and finally the fish are brought into the bag in the bunt and drawn to the shore. This is an ingenious device, and I have not known of it being used anywhere except in Russia for the capture of fish.

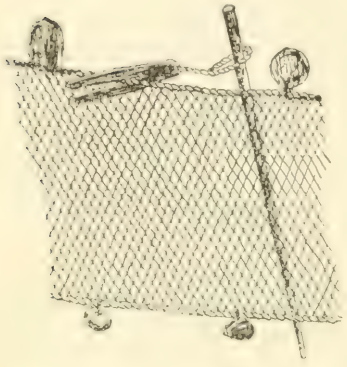


FIG. 212.—Section of salmon net. (Drawn by W. H. Abbott.)

The method of setting salmon gill nets at Kurna is essentially the same as that adopted by the fishermen at and below the entrance to

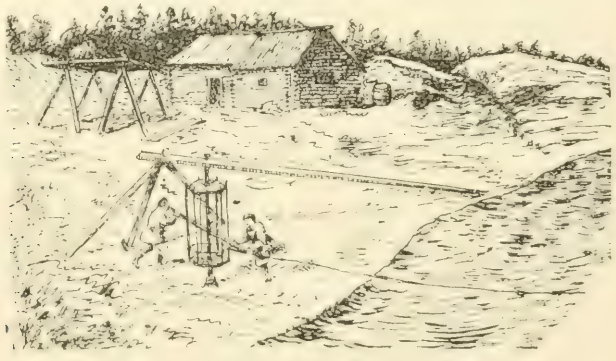


FIG. 213.—Heaving in the net warp. (Drawn by W. H. Abbott.)

Penobscot River, in Maine. The net is run straight out from shore, like a leader, but inclined downstream, so that it is at an angle with the shore of about 50 degrees. The outer part of the net is curved around to form nearly a square, the corners being held with stones or stone killicks, but the extreme end is turned inward toward the bowl, like the

HAULING A RIVER SEINE.

wing of a heart in a pound net. Thus the salmon entering a river or estuary on their way to the spawning grounds, meeting with the straight part of the net, turn offshore and enter the bowl or curved outer end. They then swim around trying to find an outlet, and finally may make a dash for liberty by rushing for the net, when they are gilled.

Seine fishing in Astrakhan.—The large seines used on the Volga and its tributaries are from 2,100 to 2,800 feet long, and two boats are always needed for operating them, the nevodnik, or seine boat, which has a seine master or pilot and 8 to 12 men in her crew, and the rybnitsa or carry-away boat, which has a crew of 7 men and carries the catch to the vataga, as the curing establishment is called. The net is shot by the seine boat, which first starts off from the shore and sets the so-called "coast-wing" of about 60 fathoms, and then sweeps around in a semicircle with the other wing, which is about 300 to 400 fathoms long, and the end of which is brought near the shore. The net is then dragged on to the beach by the fishermen, each using a hauling strap heretofore referred to (Pl. XLV).

The seine fishery is prosecuted in the Caspian in depths of from 5 to 7 feet, particularly in spring and fall, for the capture of pike perch (*Lucioperca sandra*, *L. volgensis*) and bream (*Abramis brama*). The seines used have wings of equal length.

As soon as the approach of a school of fish is announced, the rybnitsa casts anchor, while the nevodnik uses all its oars, or sails, going toward the school and gradually casting the nets. On board the nevodnik there are a pilot, six rowers, and two laborers. When the net has been cast, the nevodnik joins the rybnitsa, to which one of the ends of the seine is attached, and, all hands assisting, they begin to draw the net into the nevodnik. This last-mentioned boat is placed at a distance of 1 arsheen (2 feet 4 inches) from the rybnitsa, to which it is joined by strong transverse sticks. The net is drawn back underneath the hull of the rybnitsa. This must be done in an even manner, without any sudden jerks. In order to deprive the fish of every means of escape, the net is drawn in such a manner that the lower boltrope of the two wings slightly grazes the outside of the boat. For this purpose an iron implement is used, shaped like a heart, to the pointed end of which a long cord is attached. People fish only by daylight, and during the night the boats are drawn on shore. It is very interesting to see the fishermen go out into the sea to search for a school of fish. The experienced pilot who leads the expedition stands at the prow of the boat, constantly sounding the water with a long pole to ascertain the presence of a school, or to see whether one is approaching. He also gives the sign as soon as he thinks the moment has come for casting the net. Generally the whole school is caught.[1]

The following interesting statements regarding the fisheries on the Ural River are from a paper published in the Popular Science Monthly for October, 1893, entitled "The Ural Cossacks and their fisheries," by Dr. N. Borodine, fish commissioner of the Ural district.

After first giving a history of the settlement of the Cossacks on the

[1] Account of the Fisheries and Seal Hunting in the White Sea, the Arctic Ocean, and the Caspian Sea, by A. Schultz, pp. 76–77.

Ural River some three hundred years ago, and tracing the history of the settlement up to the present time, including the subjection of the tribe by the Russian Government in 1723, Dr. Borodine discusses the fisheries as follows:

To return to the fisheries and their importance in the life of the Ural Cossacks, I should mention that the Ural River is the only large river that is entirely given over to the fishing industry, all sorts of commercial navigation being absolutely forbidden from Uralsk to the Caspian Sea (330 miles); and more than that, in some places of the river, where sturgeons collect for their winter sojourn, no one is permitted to run a boat, to make any noise, build a fire on the shore, etc. By the laws of the community summer fishing is almost entirely prohibited, for the purpose of protecting the spawning, also for the reason that fish caught in summer will not bring a good price. They let fish enter the river from the sea and settle there quietly for the winter sojourn. All possible means are used to secure for the fish an unrestricted passage to the upper parts of the river, but not beyond Uralsk, where a railing is

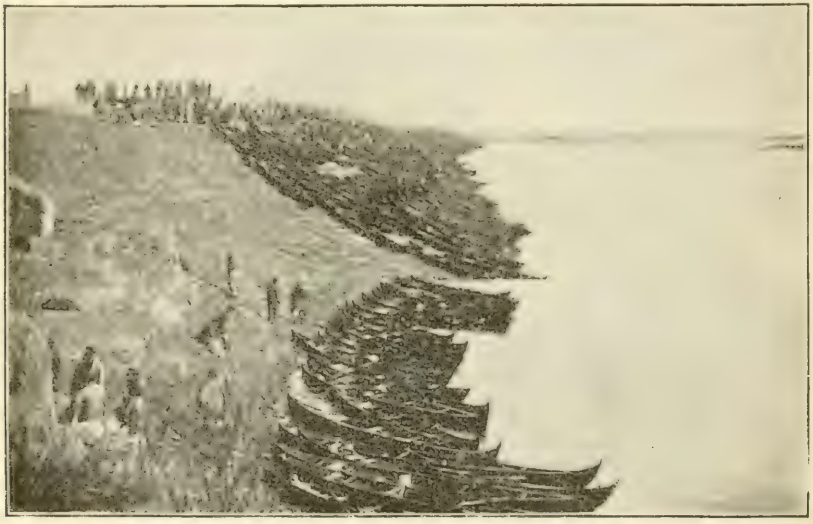


FIG. 214.—Fall fishing on the Ural River. Waiting for the signal. (After Dr. Borodino.)

constructed across the river to prevent the larger fish going farther up. Owing to this arrangement the lower part of the river from this railing to the mouth forms a large natural fish pond, 330 miles in length, where the fish are carefully watched by a great many fish wardens until the regular time for fishing, which is fixed by general consent of the community. It is easy to understand what a thorough organization is necessary to conduct successfully this complicated plan for the distance of 330 miles, and which has to deal with more than 10,000 fishermen. It is indeed a complete organization. The central administration, residing in Uralsk, controls all this business, assisted by numbers of local agents through the whole country. A steam cruiser, steam launch, and a number of sailboats constantly watch the mouth of the river and the neighboring banks and protect them from poachers. It should be mentioned that the river, with its fishing grounds and part of the Caspian Sea, belong to this entire community, consisting of 110,000 people. There is no private property belonging to individuals or villages adjacent to the river, and an elaborate and detailed general plan must exist to regulate all of this immense business in such a manner that the interest and rights of every member of the community shall be properly protected.

AUTUMN FISHING ON THE URAL RIVER.

After Dr. Borodino.

The community does not believe that these interests may be protected by free competition, as is the case elsewhere.

As a rule, one part of the river (the lower) is intended to be fished out in the fall, the other (upper) portion in winter. The fall fishing begins about the 17th of September. On a certain day the "fishing army," as it is called, moves to the fishing places, which are sometimes very far from home. The Cossack carts contain not only nets and provisions, but also the boat used in this fishing. These boats, known by the name of "boudara," are so light that two of them may be carried on one cart.

When the fishing army comes to the proper place, the boudaras are taken from the carts, and early in the morning appointed for commencing fishing they are placed at the edge of the water, right along the river for a distance hardly compassed by the eye. No less than 3,000 boats, each containing 2 men, meet here. To maintain discipline, a chief, or "fishing ataman" is appointed, and several representatives of the fishermen are elected to assist the chief. The ataman gives a signal to commence fishing by a cannon shot, and the crowd rush to the boats, and in less time than you

FIG. 215.—Fish on bank of the Ural. (After Dr. Borodino.)

can realize what has happened, all the fishermen are in their boats and a peculiar kind of boat racing commences. They put forth their utmost strength and ability to outrun each other, and to be first at the place where the fish have gathered in shoals, these places being known by the reports from the fishwardens. Once here they throw out their small seines and haul them from two boats. Various kinds of sturgeon (from 30 to 600 pounds weight), sander, carp, bream, and silurus are the principal fish caught at this fishing. The seines differ, of course, in the size of their meshes, according to the fish for which they are intended; but no one has the right to use any but the regular size, large seines being admitted only behind the fishing army. Hence, as in a noble fight, the chances of all combatants are as nearly equalized as possible by the regulations above mentioned, fixed place and time, regulated tools, etc. Success depends only on the ability and strength of the fishermen.

The total catch during the fall seining is from 54,000,000 to 72,000,000 pounds, which includes 216,000 pounds sturgeon and about 21,600 pounds caviare.

When fishing, the fishing army always goes down the river, covering from 12 to 24 miles a day, and in this way moves after a time to the mouth of the river, which is

reached, as a rule, at the end of October. At this time the ice begins to accumulate in the river and closes the fishing season.

Another army of equal magnitude, consisting of fish dealers with a large number of carts, accompanies the army. These carts are contracted to carry the catch to the city markets (there is no railroad in this steppe). No less than 10,000 carts are used here, and if you add 10,000 more carts belonging to fishermen, you may imagine how imposing must be the sight of the peaceful armies.

The fishing in the upper part of the Ural River, as I mentioned before, is carried on in winter under the ice, and that is the most peculiar of all fisheries. It is called "bagrenie," which means "hooking," because fishing is accomplished by a peculiar kind of hook. When the ice in the river becomes firm enough to support the weight of the fishing army, which generally takes place in December, an order is given by the communal administration for the army to meet at Uralsk, from which point the fishing is begun. On a fixed day thousands of people, old and young, hasten to the appointed place.

FIG. 216.—Ural fisherman equipped for ice fishing. (After Dr. Borodino.)

Let us now see how the fishermen dress for the winter fishing. One of them ready for work is represented in the picture. Light and comfortable garments, waterproof mittens and boots; in one hand a chisel, in the other two haft hooks.[1] The long one (with a haft of 7 or more fathoms) is used for catching fish lying, as a rule, in deep places on the bottom; the short one is destined to hold the fish when it is brought to the surface of the ice.

At about 9 a. m. the banks of the river, near the place where the shoals of fish have gathered, are crowded with thousands of horses and sledges, so that it becomes difficult to reach the river. Fishermen go down to the ice and stand on it in endless lines on both banks of the river, anxiously waiting for the signal, a cannon shot.

The ataman has gone out in midstream; everyone is looking for him impatiently. The signal having been given, two living waves of people rush forward to the middle of the river, and the arduous work begins, everyone trying to be the first to make a hole in the ice with a chisel. In a few minutes an entire forest of long hafts grows up over the river, as though some magic power had been at work. The fisherman moves the haft up and down and listens intently that he may know when the fish touch the hook. Once this has happened, he hooks the fish by an alert movement, then hauls it immediately up to the surface of the ice, calling in the meantime for help from his fellow-fishermen. They fish here, usually, in groups of from 6 to 20 men, for it is not easy work to pull up a huge sturgeon of several hundred pounds weight.

[1] One of these is a long-handled gaff, such as has been described, and the other a short-handled gaff.—J. W. Collins.

WINTER FISHING ON THE URAL RIVER.

After Dr. Borodino.

In a very short time the surface becomes marked with blood and covered with big fish.

The most important fish caught in the winter are different kinds of sturgeon, viz, the large sturgeon (*Acipenser huso*), Russian sturgeon (*A. Güldenstädtii*), star sturgeon (*A. stellatus*), and *A. shypa*. Each decidedly differs from the other and from species caught in America. For the flesh, and particularly the roe (caviare), very high prices are obtained in the winter season; one single big female of the "large sturgeon" is sold for 100 to 200 rubles.

Of course, not everyone succeeds in catching such a valuable fish; on the contrary, many, in spite of great efforts, do not catch any, not even the smallest sturgeon. Nevertheless, this fishing being an alluring lottery with winnings, everybody hopes to be a lucky one, and this is the reason why so many of the Ural Cossacks attend this favorite winter fishing. Not less than 10,000 people participate in it; about 240,000 kilograms of sturgeon and the same amount of other fish (sander and silurus) are caught and 30,000 kilograms of caviare prepared. The average price for sturgeon is 25 kopecks a pound, and for caviare about 2 to 3 rubles a pound.

In addition to the fisheries described above, the Ural Cossacks carry on important fishing in the Caspian Sea in spring and also in winter; the methods not being of an unusual character, I omit a description.

On some parts of the Caspian Sea coasts, and especially in the vicinity of the Volga, much of the shore fishing privilege, so far, at least, as the land is concerned, is controlled by individual landed proprietors. Certain portions, however, are free to the Ural Cossacks, but the remainder is owned or rented out by the Government, which derives large revenues from the fisheries.

A very extensive net and line fishery is carried on for the capture of sturgeon outside of the entrance of the Kur River throughout the year. In this region the Caspian seldom freezes, except where the water is very shallow, and then only a few days at a time.

A chart was exhibited showing the method of setting nets and lines. The places for each of these are designated by the Government officers. A peasant fisherman pays 50 rubles per annum for the privilege of fishing with long lines. At the beginning of the season these fishermen draw lots for positions on the fishing grounds where long lines can be set. Each trawl line is numbered and all are set in parrallel rows.

The gill nets are set in the same manner—in parallel lines—at certain fixed distances apart, and in positions officially designated. Neither nets nor lines are permitted inside of a specified distance from the river's mouth. If seines are used, the positions in which they can be operated are assigned in the same way.

It not infrequently happens that a well-to-do fisherman may be unfortunate in securing a favorable position for his lines or nets when the lots are drawn. In such cases a better position is secured by purchase from someone who is willing to sell his privilege for a certain allotted sum for the season.

The peasant fishermen who work on their own account contract to sell their catch to one of the merchants to whom they are generally in debt.

The chart referred to showed that there are various large fishing establishments along the shores of the Caspian Sea near the mouth of the Kur River, and also one inside the river's mouth. The latter is the fishing establishment of Pitoeff, who controls the river fishery, for which privilege he annually pays to the Government 1,100,000 rubles.

Fish products and their preparation. The exhibits of fish products were very creditable, and some of them excellent. The pickled fish exhibited by Saposchnikov Brothers were beyond criticism, evidencing much care and systematic treatment in curing. The dried fish displayed by this firm were also good of their kind, but far less attractive than the pickle-cured products.

The Altschuew Fishery, on the River Protoka, had good examples of cured fish, including *Alburnus chalcoides;* also sturgeon, caviare and other products of the sturgeon fishery.

Examples of cured strömming—the small Baltic herring—were exhibited by two firms, M. Leesman and B. Djernin.

The collections of canned products, though comparatively few in number, were quite extensive and embraced many varieties of fish packed in oil and sauces, especially tomato sauce.

Secondary products were also well represented. These included caviare of various species of sturgeon, isinglass from sturgeon and other fishes, the dried spinal cord of sturgeon, and other products, among which mention may be made of tanned skins of the marine catfish or wolf-fish (*Anarrhichas lupus*), and various objects made therefrom, such as shoes, reticules, pocketbooks, etc.

The caviare and other products of the sturgeon fishery were generally of excellent quality, as may readily be inferred, for every effort is made by Russian packers to secure the highest results in these classes of goods. The exhibits made by I. Pitoeff & Co., of Tiflis, The Altschuew Fishery, and J. I. Ramman, of St. Petersburg and Astrakhan, were deemed the best of this kind. Whale oil, seal oil, seal skins, etc., were exhibited.

The subject of preparation of fishery products in Russia is too large to be dealt with here, and only brief mention will be attempted. Although the facilities for transportation in the Empire are not comparable with those of western Europe and the United States, large quantities of fish are nevertheless consumed fresh, being sold at the point of capture or at the nearest large market. It must be borne in mind that the prevalence of cold weather in winter favors the marketing of fresh fish, which at that season can be kept frozen almost indefinitely. In that condition they can be transported long distances by sleds or sledges, and can thus reach the larger markets or some line of transportation connecting with them. At other seasons fish can be kept alive in welled vessels or boats, and within certain limitations can thus be conveyed to market. Still, the lack of a general system of

CLEANING FISH FOR SALTING. WOMEN AT WORK.

rapid transportation, and concurrent adoption of modern methods of refrigeration, limit the sale and utilization of fresh products materially, and consequently make necessary certain systems of cure by salting, smoking, or canning. It is true that in spring, while the weather still remains cool, fish are shipped in ice from the mouths of the Volga and Don, and on fast trains they sometimes go as far as Berlin. The finest sturgeon, however, are frozen for two or three days by a mixture of salt and ice; they are then rolled in hay to keep the frost in, and packed in a special kind of large basket made for this purpose, in which they can be kept frozen for four or five days. This sort of freezing has been practiced by the fishermen of the Azov "since the latter part of the sixties, and was also used on the Murman coast in 1878." It is a

FIG. 217.—Unloading fish into a chute.

matter of interest that a freezing house, like those in the United States, has been erected in recent years by Dr. Borodine in Uralsk. But even in this I understand salt and ice are used for freezing, and the most modern ideas of refrigeration are not utilized. A freezing house similar to that at Uralsk has been built at Otschakov, on the Black Sea coast. But the so-called "natural freezing rooms" are in favor in Astrakhan and are chiefly used. They are so arranged, in some cases at least, that wagon-loads of fish can be driven to the top (fig. 217) and the fish can be unloaded into a chute, through which they are carried to the cooling room.

The method of curing stockfish at Gavrilovskaia Bay, on the Murman coast, is in most particulars like that so long followed by the Nor-

wegians. In curing roundfish, the Russians take off the heads, but do not open the napes, simply splitting the fish to their tail from a point below the napes; the fish are then strung on a pole, which passes through the nape openings, and the ends of these poles rest on wooden horses. In this way the fish hang until they are thoroughly dry, when they are piled in oblong stacks, like cord wood, held in place by vertical poles at each end, and weighted down by poles laid on top.

In addition to the above-described method of curing stockfish, the Russians split them open from nape to tail, and cure them in precisely the same manner as the Norwegians. Klipfish are also made in the usual manner, by being split open and part of the backbone removed, lightly salted, and hard dried. Other fish are cured round. Cod heads are dried whole or split. The former are often placed on strings and tied in bunches for easier handling.

In southern Russia, and particularly in Astrakhan, some of the smaller species of fish like the Don herring, the vobla of the Volga, etc., are not gutted for curing, but are salted whole, and some are even dried in this way. Prepared in this manner the product is known as "kolodka" a name also applied to the "sander," which is somewhat confusing. Large fish are eviscerated, and if intended for drying they are often split, or cut into sections, so that they may be more thoroughly dried, but it is considered that small fish, like yellow perch and others, in addition to those previously mentioned, can be sufficiently dried round, especially when they are cured artificially in ovens, as they often are, though this system of drying seems not to be applied to larger species, the latter being sun dried. The large dried fish exhibited, notably *L. sandra*, were simply eviscerated and were dried with their heads on. Russian authorities say it is common to dry fish this way, and also to leave the roe and milt in them.

Kutsenov says:

> The fish are cut in many different ways, sometimes the belly is opened, sometimes the back, or it is divided lengthwise into halves, or on the sides, so as to have the spine whole, etc. The ways of gashing the fish differ also. Sometimes they are cut on the inside, sometimes on the outside of the body, and more or less deep, according to the thickness, in such a way that the salt can be absorbed through the gashes.

He thinks there are as many methods of salting as of cutting the fish. While some are immersed in brine others are sprinkled with dry salt, which is melted by the moisture of the fish. The amount of salt used varies, depending somewhat on the season. In spring and fall light-salted fish are cured. The fish at the bottom of a curing butt are generally much heavier salted than others and are known as "bottom ware." In summer, when the temperature is high, salt enough must be used to effectively cure the fish.

Much care is exercised in salting. To insure as equable a temperature as practicable large salting butts are buried in the earth, under-

neath the floors, or in the lower sections of the curing establishments, so that their upper chimes are only a little above the ground (fig. 218). The fish are salted in these and left till thoroughly struck through, and sometimes longer. When required for shipment they are taken out and packed in barrels or casks, and are pressed tightly in by a person, generally a woman, jumping on a cloth that is laid on the fish from time to time as the packing proceeds (fig. 219). After the fish are packed and the cask has been coopered it is filled with brine, as already related.

Women are extensively employed in the preparation of fishery products in the Astrakhan region, and for this work wear only a loose blouse or a waist and an extremely short calico skirt over thick, close-fitting

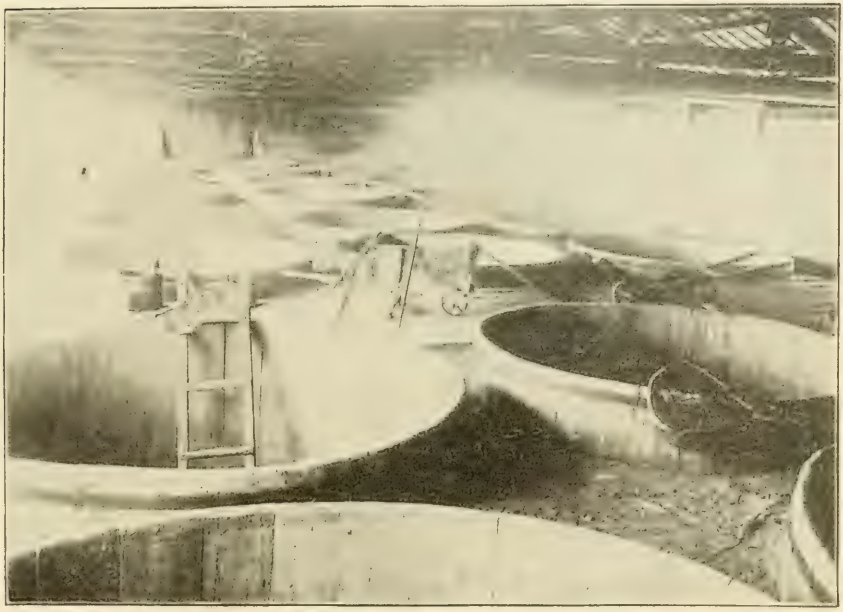


FIG. 218.—Casks for pickling fish.

trousers, which are tucked into long woolen stockings. A pair of thick shoes and a handkerchief—usually a bright-colored one tied around their heads, completes the costume (fig. 220). Two women sit on opposite ends of a plain wooden bench (fig. 221) 6 feet long, 10¾ inches wide, and provided with low cleats to hold the fish from slipping. They face each other, each astride of her end of the bench, so that she may work the easier and be able to reach the fish on the floor of the packing house or pier with the least possible hindrance. In this way many women may sit in a row in a curing house, as shown in Plate XLVIII, with the fish piled on one side of them and the washing tanks on the other, while other employees stand ready to dip the fish from the tanks into barrows to be carried off to the salting or cooling rooms.

While, as indicated, some of the salt fish is pickle cured and shipped direct to market, large quantities are dried, both in south and north Russia.

The preparation of the so-called "balyki" from the backs of sturgeon is carried on extensively, but in the eastern section of the Empire a product called "pupki" is made from the belly or lower part of the fish. The backs of white salmon and Caspian Sea salmon are also used for the preparation of balyki, according to Kusnetzov, and he is of the opinion that it is made substantially in the same way in all parts of the country.

The backs of the large fat fish are first put into salt for about two

FIG. 219.—Woman packing fish.

FIG. 220.—Women fish cleaners.

weeks, the salt being mixed with different ingredients, such as saltpeter, bay leaves, pepper, etc., so as to give a pretty color to the fish. After this process, balyki is soaked for about two days in clear cold water and then hung to dry on high racks—these being under a roof—where they hang in the fresh air for a month or more for drying. In addition to being dried, the white-salmon balyki is also smoked. The smoking is often done at the places where the fish is marketed and not at the factory.

It is claimed that very few curers are able to prepare products of this kind which have all the qualities they should possess. For they should equal smoked salmon in tenderness, and should have an orange-brown or reddish color, with "an odor something like that of the

CUTTING AND PACKING STURGEON

cucumber." In addition, they should be free from bitterness, any trace of putrefaction, and be more or less translucent.

The process of cutting up sturgeon is shown in Plate XLIX. The head is cut off with a broad-bladed ax, and the bodies of the fish are cut up with large knives, and especially with a curious double-handled knife about 2 feet long with a curved blade, the edge on the convex side and a short handle at each end.

When packing mildly cured fish in southern Russia, four women take the freshly split or cut fish, which are brought to them in a wheelbarrow or handbarrow, and strew a little salt on them, while two other women behind them pack the fish in the casks. Assisting in the work is a laborer, who forces the fish further into the barrel by standing and tramping on them with his feet, having first put a piece of sackcloth on top to keep the fish clean. Beam scales are used to weigh the portion given to the women for curing; a certain quantity of salt is required for each lot of fish, in order that the cure may be uniform and systematic. The packed product is generally weighed on platform scales. Beam scales are also used for weighing.

FIG. 221.—Fish-cleaning bench. (Drawn by W. H. Abbott.)

A fish-curing station, such as may be seen on the banks of the Volga, and locally called "vataga," is of much importance, for in addition to the building for cleaning and salting fish, the salt warehouses, the storehouses for provisions, and the buildings for trying out oil and making caviare and isinglass, there are the sheds or other structures for storage of fishing apparatus, and also the dwelling for proprietors, inspectors, and operatives. Near by fishing boats cover the shore, lie at the piers, and continuously arrive and depart, and bustling activity is everywhere observable.

The fish-cleaning establishments are called floats. They are large structures, built on piles, a few feet above the water, and the wharves, covered with planks, look like those commonly used in New England, though nothing like them are seen in the Ural region, "where the fish is generally cut and dressed in the open air, and where it is salted in tubs protected by a roof of reed or plank."

Some of the planks of the wharf are loose, and by lifting these, open spaces are made, through which the blood and refuse from cleaning the fish are washed into the water underneath the wharf. The structures on the wharf are either of wood or reeds, more frequently the latter. The front of these is provided with wide doors, to open or to lift, which are close together, with only a single post between them. In front of the buildings are devices for lifting large fish. The building, or "float," as it is called, is often divided into compartments, a large one

for cleaning fish, and smaller rooms for officers, the watchmen, and the preparation of caviare. These structures, like that shown in Plate L, vary from 150 to 350 feet in length and up to 55 feet in width. They are, however, generally quite distinct from the salting houses, which are usually near by, but commonly on the land, so that the salting vats may be put in the ground, as already stated.

The fish are received, counted, and registered at these floats by an inspector as they are delivered by each fisherman, and the price is arranged according to the measurements of the fish. Shultz makes the following reference to the preparation of fish in the Volga:

After the fish have been delivered, they are cut and the entrails taken out. For all this work there are special laborers, who display an almost incredible amount of skill and rapidity, and who receive wages which are fixed beforehand by free contract.

The head and tail of the large sturgeons are cut off, and the belly is removed from the pectoral air bladder to the tail. The belly of the smaller beluga and the common sturgeon is opened, and the head is split as far as the nasal cartilage. The "sevrugas" (*Acipenser stellatus*) are split into two halves, and the entrails thrown away. The roe, the swimming bladder, and the dorsal cord, however, are carefully taken out. These parts of the fish are handed to other laborers, whose special occupation is the manufacture of caviare and isinglass, which is carried on in separate buildings. Laborers engaged in the manufacture of caviare receive the highest annual wages.

A large number of young girls and women are occupied in cutting the fish. They all wear a peculiar working dress consisting of breeches and a jacket, their head and half their body being covered. A sharp knife in one hand, and a little hook in the other, the workingwoman begins her labor. Crouched with crossed legs on a straight bench, she picks up a fish with her hook, opens its belly, takes out the entrails, and throws the fish into a corner, where a large heap is soon piled up. During this time other women are splitting and cutting the fish with no less skill, and stringing them on threads made of the fiber of the bark of the linden tree, which they pass through the eyes of the fish by means of a large needle. The skill and rapidity of these women are truly admirable. Enormous piles of fish which encumber the floor disappear in a few hours, and pass to another building to be salted. A skillful woman can dress as many as 2,000 *Lucioperca* during a single day.

After having been dressed the fish are, under the superintendence of the salter, placed in layers in the boxes above mentioned in such a manner that the heads and tails alternate. The salter then throws, with a shovel, the necessary quantity of salt on every layer of fish, the quantity of salt varying according to the kind of fish and according to the season.

In the autumn the back and not the belly of the scaly fish is split open, so as to let the salt saturate more thoroughly.

The fish remain a longer or shorter time in the box, according to the different species: *Lucioperca*, one month; *Cyprinus carpio*, six days; *Silurus*, till autumn; *Abramis*, twelve days; the different kinds of *Alosa* till the month of June. The brine of the *Lucioperca* is again used for salting the *Abramis* or the *Leuciscus rutilus*, while the brine of the other scaly fish is thrown away.

In the spring the fish are taken from the boxes, washed, and dried on poles. This is done particularly with the *Lucioperca*, the *Abramis*, and the *Leuciscus rutilus*, while the *Cyprinus carpio* is dried on hurdles made of reeds. The drying process being completed, the fish are taken from the poles or from the hurdles, laid up in ware-

houses, and in July shipped by steamer to Nizhni-Novgorod. In September large boats arrive at the "vatagas" (fishing establishments), where they buy the fish on the spot, being salted before they are shipped.

The preparation of secondary products, and especially of caviare, is a matter of much importance in Russia. The most highly prized caviare is made from the sturgeon, and the universal appreciation of this has led to such a demand for caviare that the roe of other fish has been extensively used for making cheaper grades of this product. The pike-perch (*Lucioperca sandra*) is noted for its large yield of roe, which, together with the roe of the Caspian roach and the bream, is prepared as scaled fish caviare. Most of this is exported to Turkey and Greece. According to Dr. Grimm, more than 3,500,000 pounds of

FIG. 222.—Making caviare.

this product used to be exported yearly from Astrakhan, but more recently only about half that amount is the annual export.

This is prepared chiefly, if not wholly, by Greeks, who purchase the roes at the fishing establishments. "They draw from the body of the fish the little bags which contain the roe," says Schultz, "throw them together promiscuously, and cover each layer with a certain quantity of salt. They then press the whole between boards weighted down by heavy stones. This caviare remains thus for a month, after which the Greeks put it in casks and ship it. Caviare which has been thus prepared is cut in slices shaped like disks, and is much sought after in Greece."

The bulk of caviare for exportation is of the hard or pressed variety, or at least that intended for transportation to long distances, but fresh or "grained caviare" is also prepared from the sturgeon. In either case the roe is laid upon a sieve, which is placed over a suitable recep-

tacle. The operator then presses, or rubs, the roe gently so as to separate the eggs from the ovarian sack that surrounds them, and permits them to pass through the meshes of the sieve until nothing remains in the latter of the whole mass but the cellular tissue, the fat, and the muscle (fig. 222). The black or brown eggs, looking like small shot, lie in the tub or other receptacle underneath the sieve. The grained caviare is prepared by sprinkling the eggs with fine, clean salt, which is carefully stirred into the mass with the wooden fork described elsewhere. Of course the amount of salt varies with the season, less being required in cool weather than during the heat of summer, and as the "fresh" caviare that has the least salt is most highly prized, that cured in winter, spring, or fall is thus prepared. In cold weather only from 1¾ to 2½ pounds of salt are required for 36 pounds of caviare of this kind, but in midsummer from 3 to 5 pounds are used. When the salt is first mixed with the eggs, the mass has a doughy, sticky appearance, but when the salt has struck through the roe, and every egg has felt its influence, "the whole mass swells, and in stirring it a slight noise is perceptible, like that of stirring small grains of glass."

This indicates that the product is ready for packing, and it is placed in linden-wood barrels. No other wood is used for caviare barrels, for linden wood is the only kind known which will not give a bad flavor to caviare.

The pressed caviare is made differently. The receptacle under the sieve is half filled with brine, which varies in strength according to the season. To insure a uniform action of the brine on the eggs the roe is stirred continuously with a wooden fork, which is always turned from the same direction. The eggs are dipped from the brine with fine-meshed round sieves, and the pickle is allowed to drain, but in order to get it all out the caviare is put into sacks made of linden bark, 108 pounds to each sack, and is subjected to pressure until it is reduced to a compact mass. This process involves a loss of from 28 to 33 per cent, due to the crushing of eggs, the contents of which flow off with the brine. After the pressing is completed the caviare is packed in casks, each of which holds 1,080 pounds. These barrels are lined inside with napkin linen, which has led to the adoption of the trade name of "napkin caviare" (*caviar à la serviette*) for products packed in this way. Large quantities of caviare are now also canned in tin boxes in the ordinary way.

But the caviare which has been most lightly salted and pressed—that considered the finest—is packed in straight, cylindrical linen bags, and is known to the trade as "sack caviare."

Sometimes the roe has been spoiled, and the ovaries are soft and tender to the touch. In such cases they are put into strong brine until they are thoroughly "struck" with salt. This makes an inferior article of caviare, which sells at a low price. The so-called "summer

FISH-PACKING ESTABLISHMENT ON THE VOLGA.

caviare," though a higher grade, is also sold low. The fattest caviare is produced in midsummer from roe taken from the species of sturgeon "caught in the sea between the 8th of July and the 15th of August." This is not pressed, but, after being left for a few hours in brine, is packed in barrels holding from 180 to 360 pounds each.

The fatness of the roe varies with the species, the season, and the condition of the fish. The small-grained caviare of the sterlet is deemed the most savory of any, but is not produced in sufficient quantities to constitute an important article of commerce. The caviare made from the giant sturgeon (*A. huso*) is more valuable in the trade than that of any other species "because its grains are larger and better looking."

It is worthy of mention that the milt of sturgeon is also packed for food, after being immersed in brine for three or four days.

Isinglass is made from the swim bladders of sturgeons, the carp, and the silure (*Silurus glanis*), the latter being the most inferior quality. The preparation consists of soaking the "sounds" for a sufficient length of time, generally several days, and then cleaning them from all extraneous matter, after which they are cut into strips lengthwise and dried, and arranged in "books" or otherwise for transportation.

The spinal cord of the sturgeon is extracted and dried for food purposes. It is called "veziga," and when boiled and cut into small pieces is considered an important ingredient in fish pies, for which alone it is used.

Oil is made from the Astrakhan herring (*Alosa pontica* and *A. caspica*) or from the visceral fat of the pike perch, or sturgeons. Previous to 1854, when the salting of herring began, they were extensively used for this purpose. Large quantities of the lamprey (*Petromyzon fluviatilus*) are also used for this purpose, as has already been stated. As a rule, if not in all cases, the refuse is now used for guano, though formerly, according to Schultz, it was obligatory to bury the residue in the ground, for it was strictly forbidden to throw it into the water.

Oil and guano are now obtainable chiefly from the herring. The fish are boiled in large kettles, half filled with salt water, until they are reduced to a pulpy mass (fig. 223). The product is then pressed, and the oil mixed with water is first extracted. The refuse is spread on the ground to dry, and if the weather is good the process of drying may be completed in three or four days. The guano is shipped to Japan in bast bags and is used to fertilize rice fields. The process is similar to that formerly adopted in the United States for the manufacture of oil and guano from the menhaden, and the work is generally if not always done outside of a building.

The process of canning fish products began in Russia in 1877, when Mr. J. J. Roman built the first cannery. The business has developed rapidly, until now there are more than 30 canneries in operation. In

1884 the Odessa firm of W. A. Dubinin packed 10,000 cases, but in 1893 their output was 210,000 cases. There has also been a noticeable advance in methods and in the attractiveness of the packages.

Some thirty species of fish are packed in oils and tomato sauce. Among these are Russian sardines (*Engraulis encrassicholus*), mackerel (*Scomber*), "Sultanka" (*Mullus barbatus*), "kefal" (*Mugil saliens* and other species), the tunny (*Thynnus vulgaris*), sturgeon (*Acipenser guldenstadtii* and *A. huso*), "laban" (*Mugil cephalus*), pike perch (*Lucioperca sandra*), also *Carnax trachurus*, *Rhombus meoticus*, and other species. These are practically all packed in flat cans, oval, circular, and square.

The processes of canning are so well known and so universally

FIG. 223.—Fish oil and guano factory.

adopted in all countries where the industry is active, that extensive consideration seems unnecessary.

Fish culture.—The exhibits of apparatus, models of hatcheries, and appliances used for hatching fish, or the transportation of eggs and fry, and a collection of photographs of hatcheries and methods of work, etc., all served to convey an excellent idea of the development and present condition of fish culture in Russia.

It may be said at the outset that the artificial breeding of fish in the Empire, while prosecuted on quite a large scale under Government patronage, differs materially in the matter of distribution of eggs and fry from the system adopted in the United States. For instead of

applicants receiving these free, as is customary in this country, it appears that persons desiring young fish must pay a certain amount for them. Public fish culture, whereby the Government undertakes to increase the supply of food-fish in large bodies of water, apparently has not yet attained important proportions in Russia. Nevertheless, the artificial propagation of fish has advanced materially, and the success attained indicates further progress.

Hatching fish by artificial means was begun in Russia soon after the middle of the present century, when experiments were conducted by Vladimir P. Vrasski, a landowner, in the province of Novgorod, and also by Mr. Malyschew, at Fagil, in the Ural district. The latter was an assistant druggist, and his first attempt was to artificially breed leeches. Later he hatched perch and other species, including pike perch (*Lucioperca sandra*).

But the credit of establishing pisciculture in Russia is given to Vrasski, whose persistent and well-directed efforts led to present conditions. On his estate at Nikolsk, in Novgorod, were several lakes which he believed might be made to yield a revenue by stocking them with desirable species of food-fishes.

He followed the methods of Professor Coste, of France, for the artificial impregnation of salmon and sturgeon eggs, but the results were unsatisfactory. After much experimentation and careful microscopical study, he finally discovered the so-called "dry method" of impregnation. He also learned how the development of the embryo may be retarded by a low temperature, a matter of much moment to piscicultur ists.

The death of Vrasski occurred December 29, 1862, but before this he had seen numbers of young trout in the five ponds of the large breeding establishment he had constructed at Nikolsk.

It is considered probable that his achievements in pisciculture would have been lost to his country after his death except for the fact that the estate and hatchery at Nikolsk were purchased by the Imperial Government and placed under the supervision of the department of agriculture and imperial estates. Since then the work has been prosecuted officially. Recognizing the vast importance of artificial propagation of fish, the department took up the work zealously, placing it under the direction of Repinski. The latter fortunately had associated with him as assistants several practical fish culturists—Rybkin, Rulew, and Traschin. The last named is still in the hatchery.

Although up to this time nothing had been done beyond stocking the ponds on the estate, Repinski was soon able to begin the sale of fry and yearlings of trout (*Salmo fario*) and white-fish (*Coregonus baïrii*) to parties who desired them for stocking their private waters. Little was known about fish-culture at that time, however, and the general belief prevailed that it was impossible to raise artificially bred

fish. Consequently there was no sale for fish eggs, and the demand for yearlings was small.

The question of transporting either fish or eggs was associated with their sale, and suitable apparatus had to be devised. That invented for packing eggs was so efficient that it is still in use.

The work gradually progressed, and as early as 1879 a number of practical fish-culturists had been trained and fitted to carry on fish-culture at other points. Among these was Mr. Alexandror, the present superintendent of the substation at St. Petersburg. In addition, much has been done in aiding the establishment of private fish-cultural stations.

After the death of Repinski, in 1879, Dr. Oscar Von Grimm was placed in charge of the work, and he has continued in that capacity

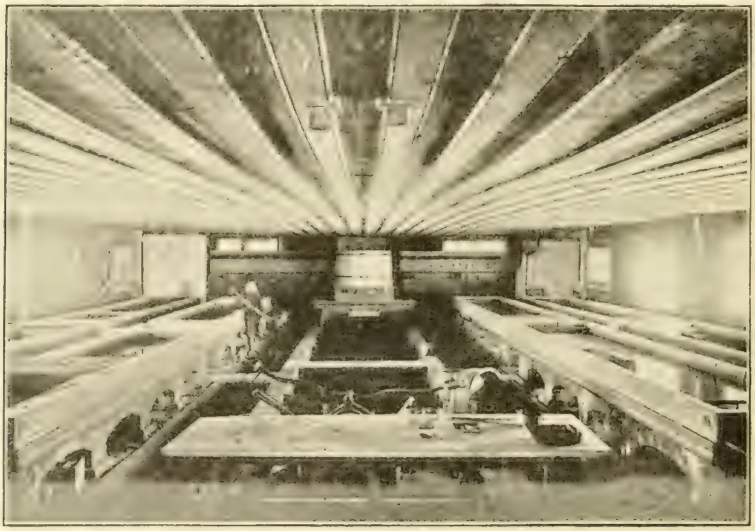


FIG. 224.—Interior of Nikolsk hatchery.

until the present time. He had previously taken much interest in the study of fish-culture and was prompt to recognize its great importance to his country, where the consumption of fish is increasing and the continuance of their abundance must depend on artificial propagation.

It was found possible at this time, under the auspices of the agricultural department, to organize the work on a new and comprehensive basis, so that, in addition to the prosecution of practical fish-culture, certain studies and researches could be conducted for the obtainment of knowledge bearing on the subject of artificially breeding and raising fish. This new plan involved a division of the work into five parts, as follows:

I. The practical solution, by scientific means, of different problems arising from fish-culture and fishing.

II. The dissemination of knowledge concerning fish-culture and the raising of food fish among landed proprietors.

III. The education of practical fish-culturists.

IV. To promote the artificial raising of fish by private individuals, through advice or instruction, and by the sale of fry and impregnated eggs of valuable fish at low prices.

V. By restocking public streams, which have been depleted by overfishing, with Salmonidæ.

It will take years to satisfactorily solve many questions of high scientific interest, but conclusions have been arrived at along some lines. The determination has been reached that fish do not always return to the river or point where they are hatched. It is said "the trout go from lake or sea to those rivers or streams which are best suited to their nature and habits, no matter how far the most suitable waters may be from the place where the fry were planted."

It was found that the white-fish (*Coregonus balrii* and *C. swirii*) of the large lakes Ladoga and Onega, which breed in adjacent rivers, are not easily hatched in small lakes, but may be artificially raised in large, clear ponds if protected against predaceous species like the pike and perches.

It was determined that the sterlet (*A. ruthenus*) thrives best in ponds, for it loses the power of reproduction in streams with a strong current, the roe not developing in the female and the milt being found only occasionally in the male. It is asserted that the sterlet can be transported alive in winter for long distances, and the raising of it in ponds is deemed the most profitable work of this kind.

Earnest efforts have been made to instruct people in fish-culture who can apply it to private purposes, and in some cases persons have been granted a subvention of $150, besides receiving special instructions. The hatchery at Nikolsk, being 22 miles off the railroad and having facilities for training only twenty people in the art of fish-culture, a "branch" has been opened in the apartments of the Imperial Agricultural Museum in St. Petersburg. Here students are instructed in the methods of impregnation and in the use of various forms of fish-cultural appliances.

But the greatest encouragement to private fish-culture has resulted from the reduction in the price of impregnated eggs and fry, especially as eggs, when packed in crates on wet cotton and inclosed in boxes, can be transported long distances successfully. For instance, eggs of the Salmonidæ and Coregoni have been shipped from Nikolsk to the Crimea, the Ural, and even to Turkestan.

The work of restocking the large rivers and lakes has been prosecuted only on a limited scale, due to the fact that the funds available have been mostly used for other purposes. The chief work of this kind has been done by the Imperial Russian Society for Fish Hatching,

which has attempted to restock the rivers Luga and Vichsel with Salmonidæ. For this purpose eggs have been purchased from the hatchery at Kirsch and the Nikolsk station has furnished fry free of charge.

FIG. 225.—Hatchery at Dorpat.

Recently a yearly allowance of about 30,000 rubles has been made "for the promotion of the fisheries," including scientific researches

FIG. 226.—Hatchery at Luga River. (From Russian drawing.)

and piscicultural purposes, and this has resulted in an advancement of the work. To carry this on satisfactorily, it was necessary to build hatcheries adapted to breeding and rearing different species in the

HATCHING SALMON ON GLASS GRILLS AT LUGA RIVER STATION.

various localities, and substations were also established. Among the stations established mention may be made of the following:

(*a*) The Jurjew station at Dorpat, Livland (fig. 225), hatches *Coregonus maraena*, for the special purpose of restocking the lakes near the Baltic—the Peipus and the Vigry—which have been much depleted by overfishing.

(*b*) The station on the Luga River, near St. Petersburg (fig. 226), was built for restocking rivers with the Atlantic salmon (*Salmo salar*).

(*c*) The station at Boschi-Promysset on the River Kur, in the trans-Caspian region, for hatching the Caspian salmon (*Salmo caspica*).

About 50,000 fish of this species are annually taken, according to

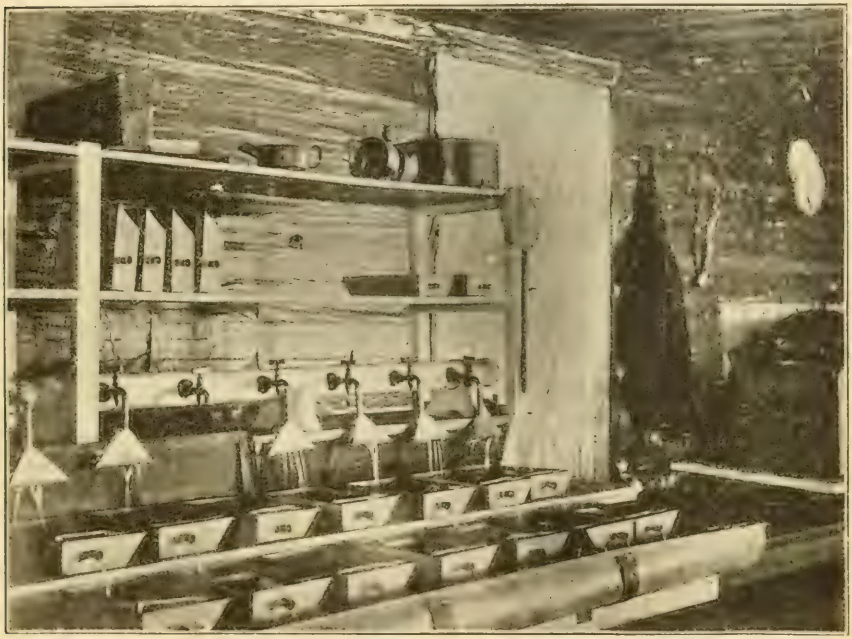


FIG. 227.—Interior of Nikolsk hatchery. Hatching pans in operation.

official statements, and it is thought the supply is decreasing. Besides those mentioned, a floating hatchery has just been started on board a vessel at the town of Ufa, which is situated on a branch of the Volga in the district of Kama. This is designed for hatching *Luciotrutta leuciehthys* and *Salmo fluviatilus*, Pall, but an attempt will be made to develop methods for breeding sturgeon.

Figure 227 is an interior view of a section of the Nikolsk hatchery, with the apparatus in operation. The hatching pans are made of galvanized iron, flaring on one side and one end, and vertical on the opposite side and end. At one end is a screen partition of wire gauze in a frame to keep the eggs from passing out of the pan, and on the same end is a nozzle for the overflow to run through. A pan of this kind

(presumably a half-size model) was exhibited. This was 2⅞ inches deep, 13 inches long, and 8½ inches wide on top; 10⅝ inches long and 6¼ inches wide on the bottom, and the screened space at one end was 1½ inches wide.

A large galvanized breeding pan, with vertical sides and flaring ends, was exhibited. This was made to fit into a wooden box, and had two gauze-wire screens, each 4 by 5 inches, at one end. This pan was 31 inches long, 22¼ inches wide, and 7⅞ inches deep.

The glass-grill system for hatching salmon (*Salmo salar*) is in favor at the Luga River hatchery. These grills are placed in boxes so arranged, one tier above the other, that the water passes from one set of boxes to those next below by gravitation. This is an old and well-known method.

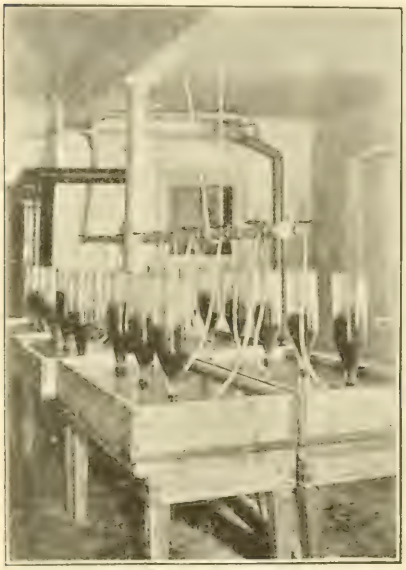


FIG. 228.—Glass hatching jars.

It may be mentioned incidentally that efforts have been made in Russia to artificially propagate the various species of sturgeon by the use of a sort of glass grill made of strips of ordinary window glass, about half an inch wide, placed edgewise close together in grooves made to receive them. These strips of glass are first covered with the eggs of the sturgeon and then carefully put under running water. In this way sturgeon have been successfully hatched, but never in sufficient quantities to be of any great importance, and the experiments so far made have not indicated the probability of a large output by this plan, unless some improvement can be made.

An open glass jar, somewhat resembling the Chase jar, is used for semi-buoyant eggs, like those of the white-fishes. These are arranged as shown in figure 228, and evidently the fish-cultural operations in Russia are not yet conducted on a scale sufficiently large to warrant the introduction of the system of installing glass hatching jars in batteries, as is customary in the United States.

Among the necessary fish-cultural appliances exhibited were the following:

1. A small cotton-cloth dip net, with triangular sides, the lower end of the handle forming one side. The total length of this is 32 inches; depth of bag, 8 inches; sides of triangular opening of bag, 8 inches on one side and 6 inches on each of the other two sides.

2. Very small cheese-cloth dip net, with circular bow, 1¼ inches in diameter; net, 1½ inches deep, and handle 8 inches long.

3. Dip net with circular bow, 2¾ inches in diameter; net, 1 inch deep, with sides of cloth and bottom of gauze wire. The handle is 27 inches long and ⅛ inch diameter.

4. Two small gauze-wire dip nets, with circular bows, for handling eggs; each with handles about 6 or 7 inches long.

5. Gauze-wire dip net with bow formed by bending two branches of the little sapling that serves for the handle and lashing them together. The bow is 3½ inches long by 2½ inches wide; handle, 20 inches long and ½ inch in diameter.

6. Section of straight glass tubing 26 inches long, ⅝ inch diameter

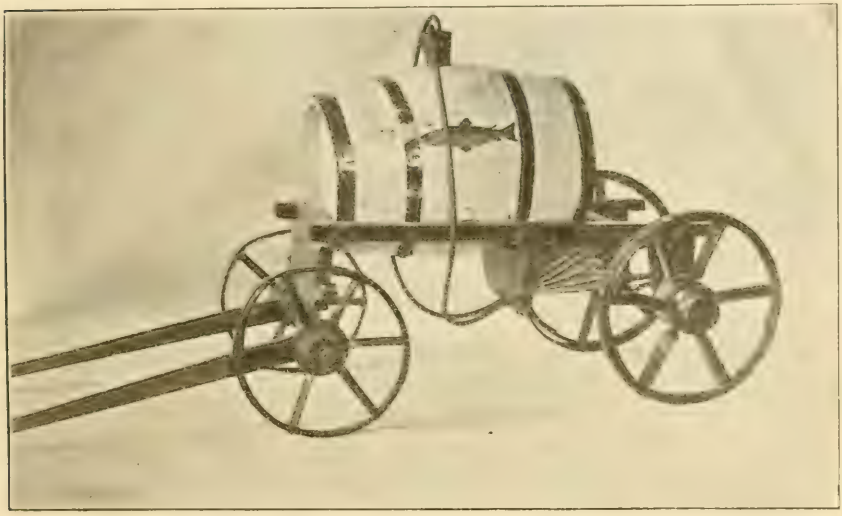


FIG. 229.—Aerating device for transporting fish fry.

at top and ⅜ inch diameter at lower end, used in connection with hatching jars, etc.

7. Curved piece of glass tubing used as siphon.

8. Egg nippers.

9. Small rake used in the examination of fish eggs.

10. Piece of bent brass wire, with tag attached, used for tagging fish.

Among the notable fish-cultural exhibits was a model of a device for aerating water when fry are being transported over country roads by horses. It consists of a large cask mounted on a specially constructed four-wheel frame (fig. 229), fitted with shafts for one horse. Underneath the rear end of the cask is a bellows, so arranged and connected with the rear axle that, as the wheels revolve, the bellows open and shut and force air into the water through rubber tubes which pass from beneath the barrel around each side of it, and through a high bung at its top. It is claimed that this simple device works well.

Life-saving apparatus and life-saving service.—While the life-saving apparatus and the life-saving service of any country must naturally be influenced materially by climatic conditions, character and extent of coast line, extent of commerce, etc., there are usually many articles used in common by all countries having lines of steamer travel or similar means of transportation.

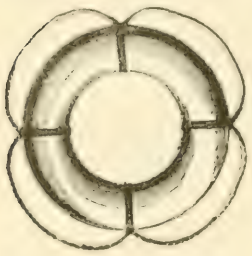


FIG. 230.—Life buoy.

Russia is no exception in this particular, but of course a country of such vast extent, situated for the most part in high latitudes, with comparatively little coast line on navigable waters, and traversed by many rivers, while numerous ponds and lakes dot its surface, must necessarily have special means for saving life that are adapted to the conditions to be met with.

Many objects intended for life-saving, or for securing the greater safety of life, were exhibited by I. F. Kebke.

Special features of this display were uncovered life belts, life buoys, etc., made of the finest quality of cork bark; also covered life belts and covered life buoys. Some of these, I am informed, are specially constructed to be used without a cover other than the canvas belt that the cork is attached to, and which serves to hold it to the body.

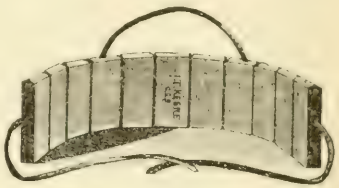


FIG. 231.—Life belt. (From Russian print.)

There are several forms of these buoys and belts, as already indicated, and reference is made to the accompanying illustrations for a clearer understanding of their shape.

Figure 230 is the usual type of life buoy carried by steamers and sailing ships. Its chief features are well known, since the best forms are simply made of good cork bark and covered with canvas, which is subsequently painted. Its usefulness consists largely in the quality of the material used, and in the rope loops attached to it by seizings.

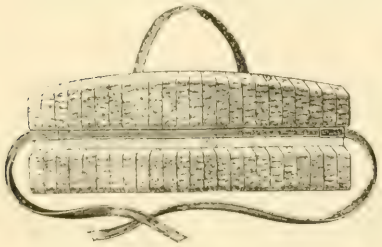


FIG. 232.—Life belt.

Figure 231 shows the ordinary form of canvas-covered life belt, commonly supplied to steamers.

Figures 232 and 233 are different forms of life belts, made of sections of cork attached to a canvas lining and belt, the latter being provided with straps for fastening the apparatus properly.

Figure 234 consists of two spheres of cork, about 8 inches in diameter, having a ring and thimble in one side, thereby permitting them

to be attached by a rope, as shown, the latter being seized together close to the thimbles, and farther up so as to form a loop into which is bent a throw-line when the apparatus is used.

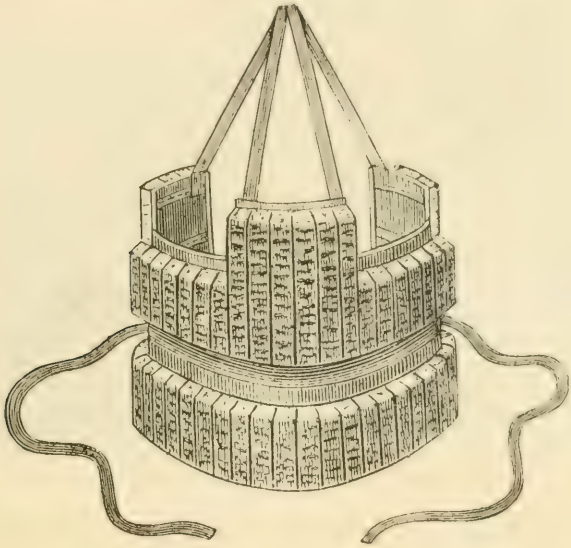


FIG. 233.—Life belt. (From Russian print.)

These floats are in principle like the bollas, used by the South American Indians for catching animals on the pampas, and can be thrown with great accuracy and for some distance by one experienced in their manipulation.

The purpose of this device is to save the lives of those who may be thrown into the water from a sinking boat or otherwise. If this occurs near the shore, as is not uncommon, especially on rivers, the life saver runs to the edge of the shore, whirls the cork floats around his head, to gain momentum, and then sends them out to the people in danger (fig. 235).

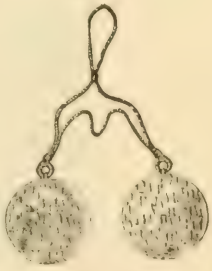


FIG. 234.

Mr. Kebke also exhibited a canvas-covered unsinkable sailboat, with life lines stretching along its sides. This was an ordinary round-bottom, square-stern, keel boat, about 14 feet long, carrying a standing lugsail. Its chief feature was its construction and life-line attachment for safety.

In the life-saving section of the Russian exhibit were shown models of ladders used for saving life on rivers, or other interior waters, when the ice breaks, as it not infrequently does, under the weight of horses and men, with the result that all are precipitated into the water and with small chance of being saved, except by timely rescue.

These ladders are arranged in three attached sections, the ends being made to fold over on the center; one is simply to increase the length, and the other has attached to it a float to give additional support if necessary. The middle of the ladder is provided with supported hand rails on each side, and this section has no crossbars or rungs, the object

FIG. 235.—Throwing floats. (From Russian print.)

being to leave a space free for the feet of the one pushing the apparatus over the ice.

When the ice breaks and life is in danger in consequence, the life saver runs to the scene of disaster, lays the ladder on the ice, and grasping the hand rails on each side of the center, pushes the apparatus rapidly over the frozen and partially broken surface (fig. 236);

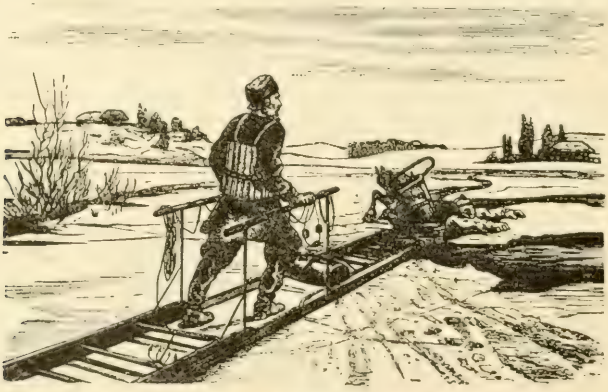


FIG. 236—Using life saving ladder. (From Russian print.)

going as near as possible, he throws a line to the people struggling in the water and pulls them on the ladder, or to safety on strong ice.

If necessity demands it the forward end of the ladder, with its attached buoy—usually a cask—is turned so that it will project forward and thus increase the life-saving chances.

When ice breaks and people are imperiled in consequence, rescue is often effected by the use of a light double-ended boat made especially

FIG. 237.—Hauling boat over broken ice. (From Russian print.)

for the purpose, which is dragged over the ice by the life savers (fig. 237) until they get close enough to take other necessary action.

A special form of ice grapnel (fig. 238) attached to a line wound on a spool is very serviceable in many cases, since it can be shoved into one end of the spool, and when the line is unwound the implement can be thrown several fathoms to catch hold of detached ice cakes upon which people may be drifting to destruction (fig. 239).

FIG. 238.—Ice grapnel.

Sometimes a line having a leaden weight at its end is used to throw to people who may be clinging to a log, or some other buoyant object, in the water. The weight enables the life saver to throw his line far out, and if his aim is true, as it generally is, success is attained (fig. 240).

FIG. 239.—Using ice grapnel. (From Russian print.)

One of the most simple and doubtless most effective devices for saving the lives of those accidentally thrown into the water near the land

consists of a few ordinary floats, like net corks, arranged on the end of a line, so that, when the line is dexterously thrown, the far end of it floats in a circle on the water. The person endangered may quickly and easily pass it over his head and under his arm, so that he can be pulled to the shore (fig. 241).

The Imperial Russian Life-Saving Society was founded in 1872, and is under the patronage of the dowager Empress Maria Feodorovna. It is composed of 10,316 members and has a fixed capital of about $270,000. Its operations extend over a vast territory—from the life-saving stations at Nova Zembla and the White Sea to the Caspian and Black seas, and from the Baltic to the distant Pacific coasts. It exhibited models of lifeboats, etc., and illustrations of methods and apparatus for saving life, some of which have been mentioned.

FIG. 240.—Throwing life line. (From Russian print.)

During the quarter of a century (1872–1897) since the organization of the society, 10,473 lives have been saved and 903 wrecks have been

FIG. 241.—Using floats for saving life. (From Russian print.)

prevented. At the present time the society supports 87 stations and 205 substations on the coast, and on the lakes it has 234 stations and 659 substations. In addition it has 79 winter stations, 87 houses for the shipwrecked, and 11 light-houses.

The rocket apparatus appears to be in favor for establishing communication with wrecks, and the breeches buoy is extensively used.

FINLAND.

Commissioner.—The commissioner from Finland was Mr. Jonas Albert Sandman, secretary of the Fisheries Society of Finland, a zoologist and an ardent student of matters pertaining to fisheries. He has contributed many papers to the literature on fish and fisheries.

General considerations.—Although Finland is a province of Russia, its exhibit was distinct and quite unlike the general Russian collections. In the official catalogue it appeared as the exhibit of Finland. For these and other reasons it is considered advisable to treat it separately here, to a large degree at least, though associating it with the general exhibit of the Russian Empire.

The fine collections constituting the exhibit of Finland were chiefly from the State Fishery Museum at Helsingfors, although four indi-

FIG. 242.—Karlo fishing boat.

viduals exhibited angling tackle; and charts, diagrams of temperature observations, etc., were displayed by the Evois Fiskeriforsok-Station.

It seems unnecessary to discuss here the fauna of Finland, the conditions of the Baltic Sea, etc., since these have been sufficiently considered elsewhere, especially in the chapter on Sweden.

Fishing boats.—No models or other representations of decked fishing vessels were exhibited. The Finland fisheries are prosecuted in open boats, chiefly of the sharp-sterned type, but generally different from those of Sweden, while some are remarkable for distinctive features rarely if ever found elsewhere in Europe.

Karlo fishing boat.—A type of clinker-built, sharp-sterned, open boat is employed in the fisheries from Karlo Island, in the Government district of Osterbotten (fig. 242). It has easy lines forward and aft, with sharp floor; raking, curved stem; keel; raking sternpost, and

strong sheer. It has two small sprit and boom sails. The mainmast is forward of amidships. The foreboom extends considerably abaft the mainmast, thus making it necessary to lift the after end of the boom and pass it by the mast whenever the boat tacks or wears. The only thwarts are the two that cross flush with the gunwales, which support the masts. One of these is near the bow, the distance from stem to foremast being only one-tenth of the boat's length, while the mainmast is not quite one-third the boat's length farther aft.

The relative proportions of a boat of this type, according to the model exhibited, are as follows: Length over all, 31 feet 10 inches; beam, 8 feet 8 inches; depth, 3 feet 6 inches; foremast above gunwale, 15 feet; foreboom, 13 feet 6 inches; mainmast above gunwale, 17 feet 10 inches; main boom, 16 feet 8 inches; oars, 12 feet.

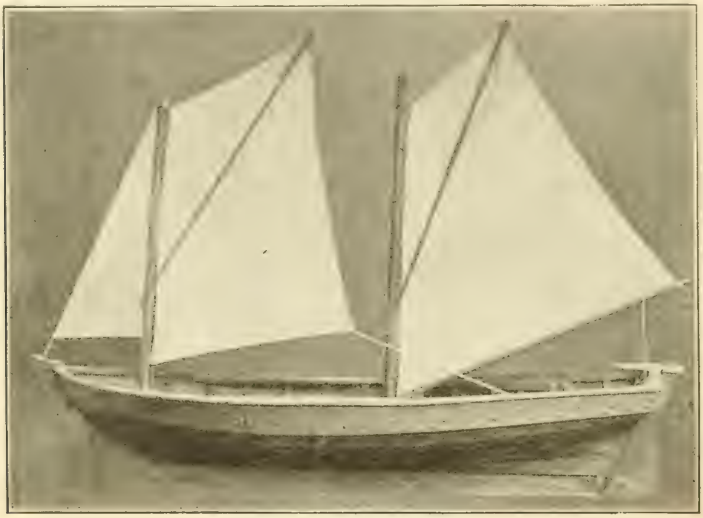


FIG. 243.—Kökar herring boat.

Kökar herring boat. A boat locally called "sköt" (fig. 243), which differs materially from the stereotyped sharp-sterned fishing boat of northern Europe, is employed in the herring fishery from Kökar, in the archipelago of Aland. It is a round-bowed, clinker-built, square-sterned keel boat, with rising floor, a fairly good run, and raking, curved stem. It is entirely open, has three thwarts, and is ceiled inside. It is schooner rigged, with two spritsails and a little jib, the latter tacking to the stem head. The foresail is loose footed, but the mainsail has a boom. The sails are bent to hoops on the masts. The relative proportions are as follows: Length over all, 25 feet 4 inches; beam, 9 feet 2 inches; depth, 2 feet 8 inches; stem to foremast, 3 feet 4 inches; foremast above thwart, 13 feet 2 inches; main boom, 12 feet 8 inches; 2 oars, each 10 feet 8 inches; 2 oars, each 16 feet.

Sastmola fishing boat.—A sharp-ended, clinker-built, open, keel boat is employed in the fisheries from the archipelago of Sastmola (fig. 244). This is the best form of fishing boat exhibited by Finland, and it closely resembles some of the Swedish boats, particularly those from Gotland and Piteå. It has fine, well-formed ends; sharp floor; raking, curved stem and sternpost; square-heeled rudder, and very little sheer. It is entirely open, and has three pairs of flat wooden tholepins on each side.

It has two loose-footed spritsails held to the masts by rope lacings. The foremast is about one-sixth the boat's length abaft the stem, and the mainmast is a little forward of amidships. The sails are nearly of equal size, and the clew of the mainsail is about as far forward of the

FIG. 244.—Sastmola fishing boat.

stern as the foremast is from the stem, consequently the center of effort of the sails is directly over the middle of the boat.

The relative dimensions are as follows: Length over all, 22 feet 10 inches; width, 7 feet 2 inches; depth, 2 feet 8 inches; foremast above gunwale, 12 feet 3 inches; mainmast above gunwale, 13 feet 8 inches; oars, 11 feet 4 inches long.

Hangö fishing boats.—The fishing boats used at Hangö, in southwestern Finland (fig. 245) are clinker-built and open, with long, sharp, overhanging bow; rising floor; very little run, and rather heavy, square stern. They usually carry a single spritsail, with or without a boom.

Wasa fishing boat.—A type of sharp-ended, clinker-built, open, keel

boat is used in the fisheries from the archipelago of Wasa (fig. 246). It has a sharp floor, a raking, curved stem and sternpost; but is notable for having high vertical washboards, which run nearly from the stem to the sternpost, and amidships are two-thirds as high as the boat itself. These are put inside of the gunwales, and are held to the latter by long hasps. The inside construction of this boat is similar to

FIG. 245.—Hangö fishing boats.

that of the Norwegian four-oared boat, in the matter of having cross beams under three of the thwarts.

The following are the relative dimensions of a boat of this type: Length over all, 18 feet 7 inches; width, 5 feet 3 inches; depth, 18 inches; washboards, 12 inches high; mast, total length, 9 feet 9 inches; oars, 8 feet 9 inches.

Wasa punt.—An open, square-ended, flat-bottomed punt, called "ekstock," is used at Wasa, in the district of Osterbotten (fig. 247).

FIG. 246.—Wasa fishing boat.

The sides flare slightly, and the bottom rises in a long, easy slant at each end. The ends are extended by pieces of thick plank, carved so as to continue the upward curve. The two thwarts are on top of the gunwales. The row locks are peculiar. They consist of straight pieces of wood that ship into heavy cleats on the inside of and below the gunwales, and extend about a foot above them. From the after

side of each of these pieces, near its top, extends a curved, spur-like arm, the outer point of which is nearly as high as the top of the stick, thus forming a rest or rowlock for the oar.

Following are the relative dimensions of this type of boat: Length over all, 14 feet; width, 3 feet 11 inches; depth, 16 inches.

Lake Ladoga fishing boat.—A very curious form of fishing boat is

FIG. 247.—Wasa punt.

used from the archipelago of Koxholm in Lake Ladoga (fig. 248). It is a clinker-built, open, keel boat, with convex, sharp ends, moderately rising floor, and stem and sternpost tumbling in strongly at upper ends. The remarkable feature is the keel, which is very deep forward for nearly half the boat's length and extremely shallow aft. It is steered by a wide, shallow rudder hung outside. It has six oars, three thwarts, and carries two small loose-footed spritsails. The center of effort of the sails is necessarily well forward.

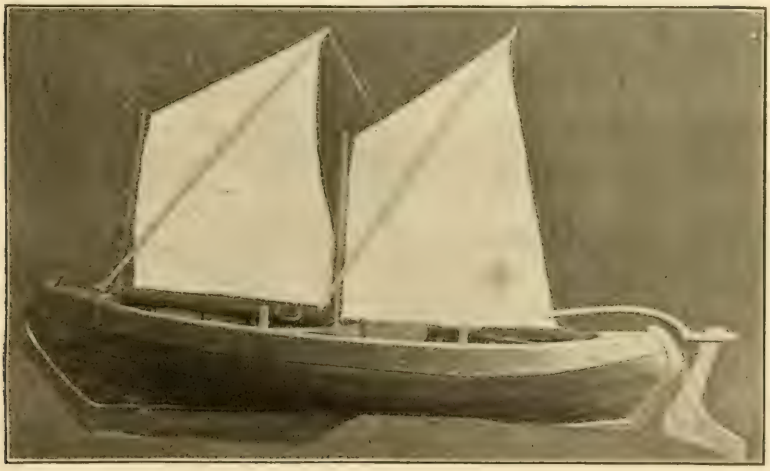


FIG. 248.—Lake Ladoga fishing boat.

The relative proportions of a boat of this class are as follows: Extreme length, 23 feet 4 inches; on top, 21 feet 4 inches; beam, 7 feet 2 inches; depth, 2 feet 4 inches; foremast above gunwale, 6 feet 4 inches; mainmast, 6 feet 4 inches; stem to foremast, 2 feet; center to center of masts, 7 feet 8 inches; width of rudder, 3 feet; oars, 8 feet 9 inches long; depth of keel, forward, 16 inches; aft, 2 inches.

Wiilasaari fishing boat.—A lightly built, sharp-ended, open, clinker-built boat (fig. 249) is used for fishing at Wiilasaari, in central Finland. It has long fine ends and a narrow flat bottom pointed at each end. The stem is strongly curved and tumbles in at the top. The sternpost curves abruptly at its lower end and is straight with a moderate rake above. This light boat is adapted to rivers or other narrow inland waters.

Its relative dimensions are as follows: Length over all, 21 feet; width, 4 feet 6 inches; depth, 15 inches.

FIG. 249.—Wiilasaari fishing boat.

Uleå River boat.—For shooting the rapids on the Uleå River and for fishing, a sharp-ended, clinker-built, open boat is used. It is entirely open, with convex lines forward and aft that give much buoyancy. It has strongly raking curved ends, round bottom, shallow keel, and good sheer. There are no thwarts, but a low platform at each end inside for one to stand on. It has paddles with dagger-shaped blades.

The relative proportions of boats of this type are as follows: Length over all, 20 feet; beam, 5 feet 1½ inches; depth, 18 inches.

FIG. 250.—Net sinker. (Drawn by W. H. Abbott.)

Sealing boat.—The boat used for seal hunting on the Baltic is referred to under the head of "seal fishing." It is exactly like the Swedish seal boat, and reference is made to the description of the latter for details.

Apparatus of capture.—The fishing apparatus of Finland is closely allied to that of Sweden in many respects, but in some of its features resembles forms common in neighboring sections of the Russian Empire.

Sealing implements.—The appliances used in the capture of seals are similar to those employed by the Swedes. Reference is made to them under the head of "seal fishing."

Nets, etc.—Gill nets and other similar fishing appliances are made of cotton and linen in Finland, and some of the fabrics of this kind indicate a high order of workmanship.

There is very little, if any, difference between the nets of Finland and those of the Baltic coast of Sweden, for the simple reason that they are used for the same species of fish, and the small herring sought by the Finns is the same fish that the Swedes call the "ströming."

A curious form of net sinker (fig. 250) consists of a stone inclosed in plaited strips of birch bark, and held in the center of a wooden ring by the bark, which extends to the ring in four directions. The ring is secured to the footrope of the net by a lashing.

It is interesting to note that some of the Alaskan Indians make net sinkers almost like this. The fishermen of our Great Lakes use iron ring sinkers on gill nets, set on the reefs, for white fish, etc. These nets are sunk to the bottom, and the iron hoops used for sinkers are large enough in diameter to keep the foot of the net off the rocky bottom and prevent chafing. It is quite possible that the fisherman of Finland and the Indians have adopted the type of sinker referred to for the same purpose, and inasmuch as they could not secure iron hoops they have shown much ingenuity in the construction of this device.

Fykes, traps, weirs, etc.—A fish net, locally known as "Storrys sja," of the fyke-net pattern is used on the river Wnoksen for catching salmon, and is so arranged as to intercept the fish when they are swimming in one direction. It consists of a leader attached to poles and with two or more fyke nets arranged at right angles to the leader. The mouths of these fykes are extended by poles driven into the mud, and the outer end, or apex, of each fyke is attached to a pole, so as to extend it. Each fyke has seven hoops and is of the ordinary pattern (fig. 251).

In Lake Ladoga a double fyke-net trap is used, locally called "Maatka." It consists of a leader varying in length according

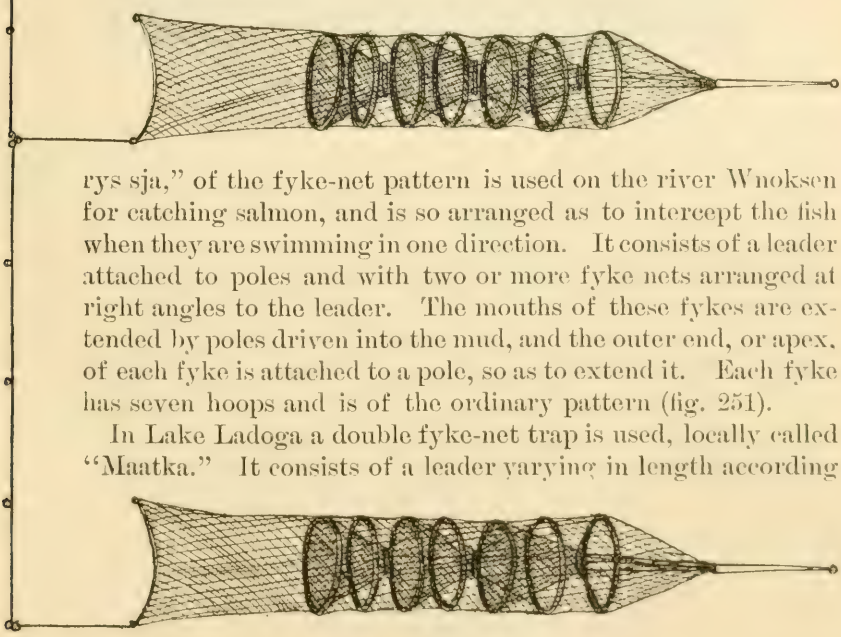


FIG. 251.—Fyke-net trap. (Drawn by W. H. Abbott.)

to requirements, running outward into an oblong-shaped bowl, from each side of which extends a 5-hooped fyke. The entrance to these fykes and the leader are supported on poles. The whole apparatus is much like forms of fish traps employed in certain sections of the United States.

A so-called great fish trap ("Storrys sja") is used at Kyrkslatt, district of Hyland, near Helsingfors. It consists of a leader and heart-shaped entrance fastened to poles, with stone sinkers and cork floats,

leading into a large 8-hooped fyke, the outer end of which is drawn into position by a rope running through a single block to a stake or anchor.

Numerous models of various forms of salmon fish pens or traps used

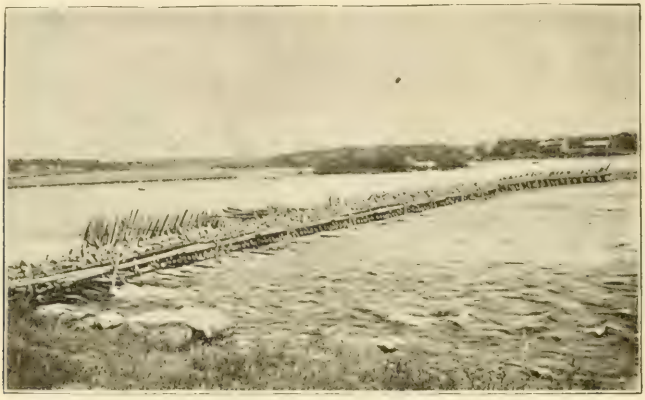


FIG. 252.—Salmon weir or barrier at Uleåborg, North Finland.

in Finland were exhibited. Some of these resemble the weirs for herring fishing on the east coast of Maine, being constructed of poles placed closely together. These are tied to a framework heavily ballasted with stones. A leader thus constructed directs the fish into a piling inclosure, where they are taken out either by seining or otherwise. A pen of this kind used on the river Tornea is locally known as "karsinapata." One used on the river Kemi and another on the river Siikajoki have openings through a barrier leading into fyke nets. The former is called "Laxpata," or salmon trap. Some of these pens are cumbersome timber structures, evidently built with the purpose of withstanding the strain of the ice and heavy current of the river. These have wooden traps opposite openings in the barrier that extends across the stream, so as to intercept the salmon in ascending the river for spawning. One of these is used on the river Kymmens.

FIG. 253.—Plan of Lake Saima fish weir.

The salmon weirs or barriers built across the river at Uleåborg, north Finland (fig. 252), are similar in form and general construction to those elsewhere. They are built with double rows of large stakes, driven into the bottom and heavily ballasted for some distance, beyond which the structures are not so heavy or formidable.

Many models were exhibited of a type of fish weir made of stakes

and reeds, locally called "katsa." These vary materially in form. Some have only a single heart-shaped pound, while others have two or three. They are used in interior waters, usually in lakes or large ponds.

The simplest form, consisting of a leader from the shore and a single heart (fig. 253), is used at Lake Saima.

Figures 254 and 255 are diagrams of other forms, with two and three hearts, in favor in central Finland. Their form is often influenced or controlled by environment. One set in the river Kimo, near the mouth of a small stream flowing into the river, has the form shown in the diagram (fig. 256), and one placed between an islet and the main shore at Tavastland has a double heart and three leaders. One of the latter is direct, one reaches toward the island, and the other toward the shore opposite. Another at the place last mentioned has three hearts.

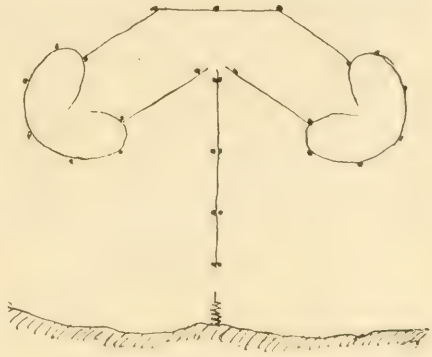


FIG. 254.—Double-heart fish weir.

Pots.—The fishing for crawfish or "krafta" (*Astacus fluviatilus*) is important in the numerous lakes, which are such a marked feature of Finland. Many different forms of pots used for the capture of this species were exhibited.

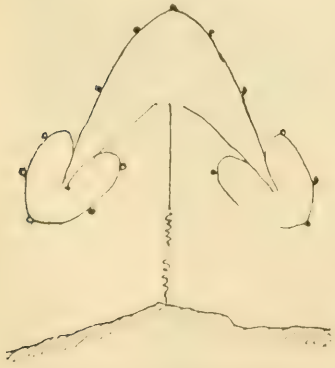


FIG. 255.—Tavastland fish weir.

One form of pot (fig. 257) is triangular in cross section, so that when set one side lies on the bottom and the other two resemble the sides of a pitch-roofed house. It is made by stretching netting over a frame and having a funnel-shaped entrance of netting at each end. The frame is made from branches of tough wood, stripped of their bark. The triangular sections are made by taking a branch, 40 inches long, and notching it at distances of 11 inches, as at A in figure 258. The branch is then bent around the stringers, and where the ends come together they are beveled, as shown at B, for a distance of 7 inches, and are securely fastened together with two or more wire nails, which are driven through the wood from alternate sides and their points clinched.

The three longitudinal strips, forming the sides, or angles of the triangle, are notched at their ends, as shown at C (fig. 259), but not in the middle.

In putting the frame together, the wood is bent at notch A around the groove C, thus making a simple, strong joint.

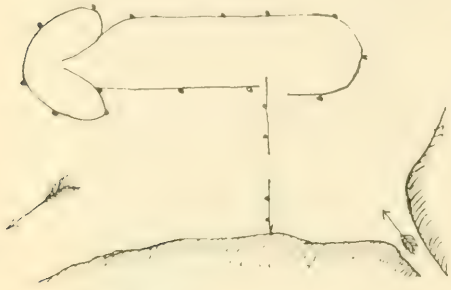


FIG. 256.—River Kimo fish weir.

This pot is 17 inches long, and each side is 11 inches wide; funnel opening, 3 inches wide.

A similar shaped pot (fig. 260) has a wire frame covered with dark blue netting, and there are wire hoops to inner ends of funnels. The latter are stretched into position by strings from the rings to opposite end of pot. The hook which holds the bait hangs from the top.

This pot is 18 inches long, 10 inches wide on sides; funnel opening, 3½ inches wide.

One form of crawfish pot is similar in shape to the most common type of American lobster pot, but not quite so high in proportion. The frame is made of half-round strips of tough wood—the crosspieces on top bent to the required curve—lashed together with split rattan. The frame is covered with netting. The pot has a funnel-shaped entrance at each end, and is weighted by two stones, one secured to each side of the bottom. This was 14 inches long, 9½ inches wide, and 6 inches high, with funnel openings 2½ inches in diameter.

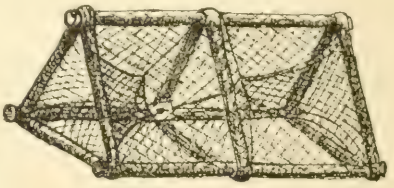


FIG. 257.—Crawfish pot. (Drawn by W. H. Abbott.)

A common type of crawfish pot consists of a wooden frame having the shape of a truncated cone and covered with netting. At the top is a cylindrical entrance made of birch bark.

The frame is made of tough wood and the uprights are secured to the circular parts of the frame, as in the pot first described, except that these curved sections are not notched and the uprights are lashed with twine at the points of intersection, instead of being fastened with nails. The crawfish are prevented from crawling up the sides, and thus escaping, by the broad band of birch bark which is fastened to the rim and projects far enough inside to obstruct the exit of the crustaceans. This apparatus is shown in figure 261. At A is a wooden peg for holding the bait. There is a bail at the top made of twisted

FIG. 258. (Drawn by W. H. Abbott.)

withes. This serves as a handle for lifting the pot, and the hauling buoy line is bent to it. The pot is 16 inches wide on the bottom, 7½ inches wide at top, and 8 inches high. The birch-bark cylindrical entrance is 3¾ inches deep.

Another form of pot is similar to that last described, except that it has a net funnel, instead of the birch-bark entrance, and the uprights are fastened with nails. It is 16 inches wide on the bottom, 7 inches wide at top, and 5½ inches deep.

Fig. 259.

The simplest form (fig. 262) has a frame something like an old-fashioned lobster net, consisting of a circular hoop at the bottom and two curved limbs extending from side to side and crossing each other at right angles, the buoy rope being fastened at the point of intersection. Netting is stretched over this frame on the bottom and half way or more up the sides, leaving a broad opening at the top. This pot is 15 inches wide at the bottom and 7½ inches to top of frame.

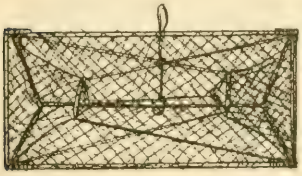


Fig. 260.—Wire-framed crawfish pot. (Drawn by W. H. Abbott.)

The "krafta" pot, shown in figure 263, is similar in design to a common form of fish pot used in northern Europe. Two U-shaped bows are fastened at their ends to straight crosspieces or sills. Fastened to these, at right angles, are several pieces of flexible withes, which are brought together and lashed at one end, while there is a funnel-shaped entrance of netting at the other. The frame is covered with netting. This pot is 15½ inches long, 10 inches wide, and 8½ inches high.

The most complicated form of crawfish pot is used at Helsingfors. This is cylindrical and shaped like a bird cage; it consists of netting covering a wooden frame. The frame has three hoops, to which nine uprights are secured. This pot has twenty funnel entrances of netting on its sides, all of which lead to the center of the apparatus. The inner end of each funnel is held in position by lines leading to a metal ring in the center of the trap. This device is 3 feet in diameter and 21 inches high.

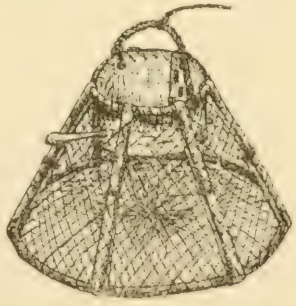


Fig. 261.—Crawfish pot. (Drawn by W. H. Abbott.)

Angling tackle.—The most noticeable apparatus under this head was a flexible decoy-fish spinner for trolling. This is shown in figure 264, and the spinner, the gang of hooks, and the several parts by which these are fastened to the fish-like decoy are also illustrated. In the latter, A is a seizing around the wire ganging that holds the hooks and the whole device; B is the ring through which the gangings pass, crossing each other, and also the junction of the spinner; C C, wings of spinner; D, narrow pointed metal pin, with bulb at top, that enters

the mouth of decoy fish and passes down nearly to its tail; E, F, G, H, hooks seized to wire gangings; I, I, I, I, hook-like barbed projections, at the rear of the hook shanks, for the purpose of attaching the hooks to the decoy fish. This form of apparatus is considered very effective in Finland.

Methods of fishing.—The methods of operating gill nets, seines, fyke nets, and other common forms of fishing apparatus are substantially the same in Finland as in the neighboring countries, especially Sweden and the adjacent regions of the Russian Empire. For this reason it seems inadvisable to repeat what has already been written, and reference is therefore made to only one branch of fishery.

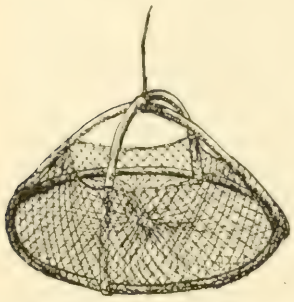


FIG. 262.—Crawfish pot. (Drawn by W. H. Abbott.)

Seal fishery.—The spring seal fishery on the Gulf of Bothnia is participated in by the Finnish fishermen much in the same manner as it is conducted by the Swedes. As spring approaches and before the ice breaks up, usually some time in March, the seal hunters leave the coast for a stay of two months or more, during which time their utmost skill is brought into requisition to shoot the seals, while their hardihood is taxed to the limit to endure the toil, danger, and hardship incident to the pursuit in which they engage. A boat's crew usually numbers about five men. It is not difficult to understand the severe task these men have in dragging the heavy scoop-shaped boat over the ice, mile after mile, until open water is reached (fig. 265). In the meantime the food, fuel, guns, small dingey, and other accessories of the hunt are moved on sledges.

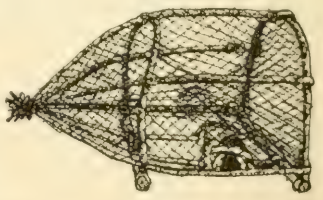


FIG. 263.—Crawfish pot. (Drawn by W. H. Abbott.)

If a favorable wind is encountered after open water is gained, sails are set on the "long boat," and the hunters thread their way among the drifting ice until they find a place that seems to be suitable for shooting. This must be strong drifting ice, which the seals prefer.

When such a place is found, the hunters pull their boat out upon the ice and encamp. Camping consists in arranging supports on each side of the boat so that she will sit upright. Then the sail is drawn over the after section so as to form a tent-like cabin, under which the crew can sleep and where their clothes and outfits are stored. Cooking is done on the ice, but the culinary operations are necessarily simple to a degree.

The nights are passed on board the boat, in the improvised cabin,

but all day long, while it is light, the hunters roam over the vast floe, seeking seals wherever they think there is probability of finding them. When the hunters begin to bring small returns, or there are indications of the ice breaking up, a new and better ice field is sought.

A sudden storm often causes the floes to break. Not infrequently the tired sleepers are awakened by an awful crash and the grinding of moving ice that makes night hideous and compels prompt action. The exigency admits of no delay, for the lives of all are in the most imminent peril. The "long boat" is hastily abandoned, and the crew fly for safer ice.

To successfully hunt seals requires skill and experience, as well as courage and hardihood. If the seal gets a sniff of his human enemy he immediately slips off the ice into the water and disappears; it is impossible to get near enough to shoot him.

The hunter, therefore, when he sights a seal, lies down prostrate on a long snow skate, called "skridslång," which has on one end (which is always toward the seal) an oblong white canvas blind, about 30 inches long, 12 inches high, spread on yards, and having a hole in the middle through which the seal can be observed and the gun can be fired when a point is reached where a successful shot can be made. In this more or less prostrate position the hunter pushes himself slowly and carefully along over the ice field, meanwhile watching the seal through the aperture in the canvas blind, until the animal is within easy gun shot, when it is killed. The gun is frequently the handiwork of a country smith, is of large caliber, and extremely heavy. Ordinarily it rests on two iron rowlocks attached to the snow skate, but sometimes there is a clumsy wooden gun case on top of the forward end of the skate in which the gun can be kept dry if the weather is stormy.

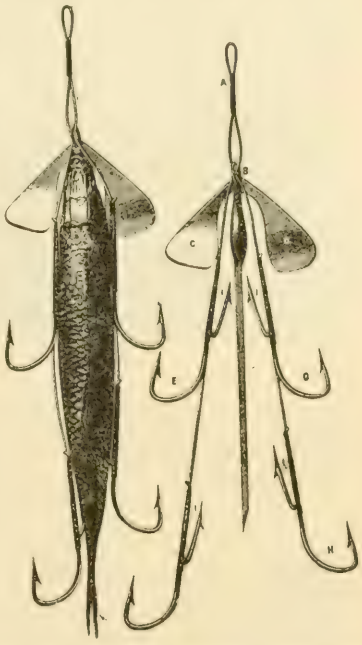


FIG. 261.—Decoy-fish spinner. (From Finnish print.)

Dangerous and laborious as the seal hunt is, it is looked upon almost as a favorite sport by the hardy and fearless coast islanders who engage in it. "They are men inured to hardship," says a writer, "steeled against winter's raw sea air and cold blasts, and used to throwing themselves fearlessly into danger."

Shooting seals on the Gulf of Bothnia has been practiced for several hundred years. An old map published by Olof Mansson indicates that it was conducted as now as early as the fifteenth century.

The boats used are similar to the seal boats of Sweden, described elsewhere. They resemble the sternum of a bird, with round ends, rising scoop-shaped bow, strongly raking sternpost, deep keel or skag aft; round bilge; clinker-build; high washboards along the sides;

FIG. 265.—Finns hauling a sealing boat over the ice.

four pairs of stationary thole pins; single short mast stepped a little forward of center, and a loose-footed square sail. They are usually about 30 feet long, and approximately one-third as wide.

FRANCE.

Commissioner.—M. Joseph Pérard, civil engineer, who has been the author of papers on the fisheries and kindred subjects, was commissioner from France.

General considerations.—France is one of the most important fishing countries of the world, and probably no other nation has so fully recognized the importance of commercial fisheries as a nursery for seamen to man its fighting navy in time of war and its merchant marine in peaceful periods. To promote and encourage these industries France supports fishery schools, in which technical instruction is given in the arts of preparing fishing apparatus, catching fish, the preparation of products, etc. It also pays a bounty to its fishermen, and protects them from ruinous competition by a high tariff on fishery products.

The fisheries of this country are varied and interesting, especially if we include those of its dependencies of Algiers and Tunis, for there is a wide range of piscatorial effort between catching cod off Newfoundland

or Iceland to the gathering of coral or the capture of sardines in the Mediterranean.

As an indication of the position held by France in the fisheries, a few figures for 1885 may be given. It is believed there has not been material change since these data were published in 1887.

In the year referred to a total of 144,097 persons were engaged in fishing, of which 85,915 were registered sea fishermen, 57,088 men, women, and children that fished "on foot" along the shores, and 1,094 on 338 Italian boats sailing from the Toulon district. The fishing fleet, exclusive of the Italian boats mentioned above, numbered 23,877 vessels and boats, with an aggregate capacity of 160,299 tons. The total value of the fisheries -in silver- -was $17,898,161, and the aggregate production of the fisheries for cod, mackerel, herring, anchovy, and other species designated as "other fish," was 414,141,515 pounds. Of this amount the Newfoundland cod fishery produced 59,239,806 pounds, worth $1,750,298, and the yield of the Iceland cod fishery amounted to 28,468,776 pounds, valued at $1,415,059. The aggregate sale for public consumption of oysters artificially raised in ponds, parks, tanks, etc., was 597,164,013, worth $2,459,730, while the product of the boat and coast fisheries was 126,579,817 oysters, including Portuguese as well as natives, which sold for $323,242. It is a somewhat remarkable fact that the seaweed gathered for fertilizer and bedding on the French coasts in 1885 reached a value of $1,060,545.

During the same year Algiers had 4,495 men employed in fishing and 1,047 boats, with an aggregate tonnage of 3,999. The product of its fisheries reached a total value of $791,566. The catch of mackerel, bonitoes, tunnies, anchovies, and those species included under the head of "other fish" aggregated 9,295,723 pounds.

Tunis is reputed to have rich fishing grounds. Over 300 tons of dried squid (*Octopoda*) are annually produced. The sponge fishery is important. In 1897 the exportation of sponges is given at $200,000 in value. It is estimated that the annual production of anchovies at Tabarca, an important fishing station in Algeria, is 2,500,000 pounds, while an equal amount of pilchards is caught. It is, however, to be noted that these fish are taken largely by Italian and French fishermen. The production of salt by Tunis will be referred to elsewhere.

The exhibit of France included collections from Algiers and Tunis. It also embraced a larger proportion of scientific implements, apparatus for navigation, and life-saving appliances than were shown by other countries, and also "wines for fishermen," but its collections appertaining to commercial fisheries were correspondingly limited. For convenience, the exhibits of France and its dependencies will be considered together.

Fishing vessels and boats.—France has a large variety of vessels and boats employed in the fisheries, but comparatively few forms were

exhibited, and many of the representations were photographs or drawings, without any accompanying data regarding dimensions, fisheries engaged in, etc.

Steam fishing vessels.—The steam trawlers, which use the otter trawl in the Bay of Biscay, the North Sea, and contiguous waters, are similar to those of England. Reference is therefore made to the description of English steam fishing vessels.

Sailing ketches and yawls.—The French employ ketch-rigged trawlers like those of the east coast of England, and also yawl-rigged vessels, which differ from the ketches chiefly, if not wholly, in their rig. One of these, of which a photograph was exhibited, is shorter in proportion than an English ketch (Pl. LII). It has a straight, slightly raking stem, moderately sharp bow, and heavy, raking, square stern. It has a pole mainmast in the same relative position as on a ketch, and pole jigger mast about 5 or 6 feet forward of the taffrail. It carries a jib, stay foresail, low and wide mainsail, club-headed main gaff-topsail, a loose-footed gaff jigger or mizzen, the sheet of which trims to an outrigger, and a club-headed mizzen topsail. The vessel referred to is about 55 feet long, and is one of the smaller trawlers of this class. Ketches engage in the cod fishery at Iceland, and sometimes they have crossed the Atlantic and fished on the Grand Bank of Newfoundland and contiguous fishing grounds. They range from 50 to 80 tons, and have about the same relative proportions as the English ketch-rigged cutter.

Fishing luggers.—The only representations of this class of vessels were in photographs. The luggers at Dieppe are short, clumsy, decked boats (Pl. LIII), about 35 to 45 feet long. Their chief characteristic features are a rather full convex bow; large body; short run, and excessively heavy, non-overhanging stern, with rudder hung outside. The mainmast stands well forward, and upon this is set a large, loose-footed, dipping lug sail. The jigger mast is at the extreme stern, and on it is set a small standing lug, the sheet of which trims to an outrigger. Vessels of this class fish on grounds near the coast and within easy reach of a market. The one in the foreground (Pl. LIV) is outward bound with a fleet of ketches.

The luggers that sail from Boulogne to engage in the drift-net fisheries for herring and mackerel are generally about 60 to 65 tons, though there may be some of this class larger and some smaller than that.

One of these I have studied had a rather full convex bow above water, but was much sharper below the water line. She was not quite so deep in proportion as the English fishing vessel; had a fairly broad beam; a moderate rise to the floor; round bilge; medium depth of keel; a long, finely shaped run; wide, square stern; and 2 or 3 feet overhang to the counter. The stem was nearly straight, and had little rake, making almost a right angle with the keel, though the

YAWL-RIGGED TRAWLER

lower part of the bow, next the forefoot, had a very graceful curve. The sternpost had only a moderate rake. The hull below the water line was very much like the hull of an American schooner of thirty years ago of the moderately sharp type, and if a low quarter deck was added, the after section from amidships would be scarcely distinguishable from the afterpart of a New England fishing vessel.[1] This lugger had considerable sheer, a flush deck, and board bulwarks about 2½ feet high.

The accommodations for the crew on a lugger like this consist of a forecastle forward and a cabin under deck aft. Amidships there is a large hatch running athwartships of the deck, almost from one side to the other. Its width, fore and aft, is 6 feet. This hatch is the entrance to the net room, where the fishing gear, nets, ropes, etc., are stowed. There are three additional hatches leading into the different sections of the hold, and a small scuttle hatch near the bow, that is flush with the deck. A tall crutch, into which the mast lowers, stands midway between the bow and the stern.

These luggers usually carry a steam capstan, which, in addition to being used for heaving in the nets, supplies the place of a windlass, which these vessels are not provided with. Steam capstans have been used since about 1873, and are found very serviceable for hoisting the sails, raising the mast, setting up the rigging, and landing fish or barrels. The principal object, however, for which they are used is for the management of the nets, for which purpose they are considered almost indispensable. Many experiments have been made for several years past to use screw steamers for this work, but these did not prove suitable, and have almost universally been discarded. The objections were that the screw fouled and injured the nets or other apparatus, and too much space was occupied by the engines, coal bunkers, etc. The additional expense of a steamer was also an important item, and tended to make it far less profitable than a sailing vessel, unless much greater catches could be obtained.

The Boulogne lugger is a two-masted vessel, and differs in many respects from the old style three-masted lugger, which is not employed at Boulogne, but is more particularly a Breton type of fishing vessel. The pole mainmast stands a little less than one-fifth the vessel's length from the bow, the foot works in a "tabernacle," and the mast lowers into a crutch when the vessel has her nets out. The forestay is set up at the stemhead with a heavy purchase, and the two shrouds on a side are kept taut by runner and whip purchases. An enormously long running bowsprit is carried, which ships out through a heavy wooden chock on

[1] The majority of the modern-built vessels composing the Boulogne fishing fleet are sharper forward than the one here described, more particularly above water. Many of them have hulls resembling the English trawlers, and of late years the ketch rig, too, has been extensively adopted by the French.

top of the bow rail on port side of the stem. The mizzenmast stands about one-fifth the vessel's length from the taffrail. It is shaped like the foremast, but is a trifle shorter. It has two shrouds on a side. A long outrigger, to which the mizzen sheet trims, projects from the stern.

Six sails are carried, namely, jib, stay foresail, mainsail, mizzen, and two square-headed gaff-topsails. The jib is very large and hoists to the extreme upper part of the main masthead. It sets "flying," as jibs commonly do on running bowsprits, and one would think it would be a difficult matter to take such a sail in with a fresh breeze on some points of sailing. The stay foresail is narrow, but has considerable hoist. It has a single reef. The mainsail hoists only about half the length of the mast above the rail, but peaks sharply. It is a gaff-sail, bent to hoops, with three reefs, a low roaching foot, and no boom. The sheet trims to a curved iron traveler, which extends from rail to rail, just forward of the mizzenmast. The main gaff-topsail is a narrow elongated sail with convex foot, and very long yard that extends about one-third of its length forward of the mast. The greatest length of the sail is fore and aft; its average width is a little more than half its length. The mizzen is a standing lug provided with three reefs.[1] The mizzen gaff-topsail is shaped like the other, but is wider in proportion.

The following are the details of construction as supplied by M. Frederic Hautier, a celebrated builder of Boulogne, who claimed, as early as 1883, to have launched from his yard a flotilla of 700 sail of vessels largely of this class:

Oak and red elm are chiefly used for the frame and scantling. The keel is 8 inches thick and 15 inches deep. The frames are oak, made up of two pieces firmly riveted together with iron, the double frame being 5 inches thick and 10 inches wide. The frames are placed 7 inches apart. The planking is half elm and half oak, 2 inches thick and varying from 5 to 6 inches in width.

Six-horsepower engines are used for operating the nets, etc. These have 85 revolutions per minute, 15 pounds working pressure, and 11.81 inches stroke. The diameter of the cylinders is 6.69 inches; height of boiler, 6 feet 8 inches; diameter of boiler, 3 feet 8 inches. There are 2 cross tubes. The boiler has a holding capacity of 0.815 meter. The area of grate surface is 69.94 square feet.

M. Hautier gives the following dimensions for a vessel of 72 tons, new measurement: Length over all, 72 feet; keel, 62 feet; beam, 19 feet; depth, molded, 10 feet; of hold, 9 feet; draft of water, aft, 10 feet, forward, 8 feet; mainmast, 48 feet; mizzenmast, 52 feet.

Following are the dimensions of the lugger described: Length over

[1] These vessels have reef points in their sails instead of reef gaskets, like the English trawlers and Dutch vessels.

DIEPPE FISHING LUGGERS

all, 76 feet; keel, 65 feet; beam, 20 feet; depth of hold, 8 feet 4 inches; draft, aft, 9 feet; forward, 5 feet 3 inches; mainmast, above deck, 50 feet 9 inches; mizzenmast, above deck, 50 feet; bowsprit, total length, 47 feet; outboard, 26 feet 8 inches; main gaff, 30 feet 9 inches; foot of mainsail, 40 feet; main gaff-topsail yard, 38 feet; mizzen yard, 28 feet 4 inches; mizzen outrigger, 20 feet 9 inches; mast crutch, 14 feet high.

No ballast is used; the spare sails, nets, stores, etc., supply the place of ballast on the outward passage and until fish are taken. The luggers carry large crews, and it is not unusual for them to have as many as 16 to 18 men and boys on board.

Two-masted and three-masted luggers are used for catching tunnies by trolling; these were represented in a painting of this fishery by Jean Connerre.

Some of the fishing luggers which have been built at Honfleur, and numbers of which engage in the drift-net and other fisheries, are full, bulky vessels, with short, convex bows and usually round sterns. I saw several French vessels of this type, or nearly like it, at Ramsgate, in England, in 1883. These luggers were about 25 to 30 tons register, carvel built, carrying two lugsails and a jib. Notwithstanding that they looked full and somewhat clumsy and old-fashioned, they appeared to move fairly quick through the water, and they tacked smartly.

Admiral Paris has published the plans of a vessel of this kind, built in Honfleur in 1866, which resembles in rig and some other details the luggers seen at Ramsgate, though it is not so large as the latter.

The vessel figured by him has a round bow and stern and a full under-water section, especially forward of amidships. It is decked, with high bulwarks, and is straight on top. It is rigged as a two-masted lugger, with a long, running bowsprit, and carries two "working" lugsails, jib, and maintopsail. The foremast stands close to the bow (about 2 feet from the stem at the deck), and the mainmast is amidships. Both masts have a moderate rake, and each is supported laterally by two shrouds on a side; these are spread very much on the rail, especially the main rigging, so that one shroud is considerably forward of its respective mast, while the other is a similar distance aft of it. The foot of the main lug is spread on a boom, and a short maintopmast is carried.

The following are the principal dimensions: Length over all, 30 feet $7\frac{3}{4}$ inches; beam, 10 feet $3\frac{9}{16}$ inches; depth, 4 feet 1 inch; draft, aft, 5 feet 1 inch; forward, 3 feet. Mainmast, 33 feet 9 inches; foremast, 27 feet $10\frac{1}{2}$ inches; bowsprit, 19 feet 3 inches; topmast, 12 feet $5\frac{1}{2}$ inches; mainyard, 22 feet $7\frac{1}{2}$ inches; foreyard, 20 feet 4 inches; boom, 22 feet $7\frac{1}{2}$ inches.[1]

[1] The above dimensions are those given by Admiral Paris, and are probably correct, although they do not agree precisely with the plan he publishes.

The lug-rigged "shallops" (bateau de peche), formerly employed exclusively by the French fishermen for the purpose of setting and hauling trawl lines on the fishing banks of the western Atlantic, and still used to some extent, are wide and deep, clinker-built, open, keel boats, with full round bows and heavy square sterns. A writer in Revue des Deux Mondes says of them:

> They are heavy boats, with about 7 meters of keel, seaworthy—but difficult to manage on account of their weight—capacious, and large. In rough weather it is often difficult to take them on board and they are lost. They are fastened on davits above the deck or are lashed firmly to the side.

These boats range in size from about 25 to 27 feet in length and are about one-third as wide as long. They carry one or two lug sails—sometimes a jigger sail aft—and a jib, and are always kept under sail when setting the lines if there is sufficient wind. If it is calm they are rowed.

They are burdensome and buoyant in a seaway, but are heavy to row in calm weather. Owing to their great weight and the difficulty of getting them on board the vessels they are nearly always left out over night on the fishing ground, towing astern of the ship at the end of a long hawser. When gales come up suddenly they are often lost.

None of those seen by the writer were provided with any roller for the lines to pass over when hauled. On the Grand Bank 6 to 8 men go in each boat to haul trawl lines. One of these men bends over the bow of the boat, in a very uncomfortable position, with his breast across the stem or gunwales, and it is his duty to clear the hooks that swing across the stem, and sometimes to lift the fish over the bow. One can scarcely imagine a more laborious and fatiguing duty, and when it is understood that the use of the dory entirely obviates such work, and also makes it possible for 2 men to do nearly the same labor that 7 or 8 are required to accomplish in the shallop, one can not wonder that the French have of late years shown a preference for the American boat. The remainder of the crew, with one exception, stand along the side and haul the line, which is coiled in baskets at the stern by one man, whose duty it is to attend to this work. While getting the lines the sails are furled and the masts taken down, with the exception of the jigger mast, which stands at the extreme stern, and on this the little sail is generally kept set to steady the boat and keep her head to the sea.

The hull of a boat of this type is coated with Burgundy pitch, and the sails are prepared with a decoction of oak bark, in which sufficient red ocher is mixed to give the canvas a dark-red color. This is done to preserve the sails.

Following are the detailed measurements of a Fecamp boat of this kind: Length over all, 27 feet 3 inches; on keel, 25 feet 9 inches; beam, 9 feet 8 inches; depth, 3 feet 11 inches; mainmast, total length,

26 feet 3 inches; diameter, 15 inches; yard, 17 feet; jigger mast, 13 feet 9 inches; outrigger, 11 feet 9 inches; bowsprit, 20 feet 2 inches; total sail area, 50⅔ square yards; oars, 19 feet 8 inches. The keel and stem of this boat are 7 inches wide, and the frames 5½ by 2⅜ inches.

A two-masted fishing lugger, employed by the fishermen of Brittany, is similar in form to the boat last described. It is an open, square-stern keel boat; wide and deep, with considerable sheer; straight stem and sternpost, both having a moderate rake; a full midship section, making the boat "bunchy" in the middle; no overhang to the counters; the rudder hung outside, and tiller worked through a hole cut in the upper part of the stern. Stone ballast is used.

The boat is fitted with a running bowsprit, and the masts have a strong rake, though less than some of the boats of southern France and of Spain.

It carries two lugsails and a jib. The mainsail is a working lug, and its foot is bent to a boom which is attached to the mainmast by a goose neck. The foresail is a compromise between a dipping and working lug. The foremast is stepped close to the stem and the mainmast about amidships.

The following are the principal dimensions: Length over all, 17 feet; on load water line, 15 feet 6⅔ inches; beam, extreme, 7 feet 4 inches; draft, aft, 3 feet 3⅓ inches; forward, 2 feet 7½ inches; mainmast, 18 feet 11½ inches; foremast, 18 feet 7⅔ inches; bowsprit, outside, 7 feet 2⅓ inches; main boom, 13 feet; main yard, 11 feet 4 inches; fore yard, 8 feet 6 inches.

Sardine fishing boat.—A lug-rigged boat is employed in the gill-net fishery for sardines from the coast of Brittany. It has a sharp wedge-shaped bow; moderately rising floor; quick turn to bilge; lean run and round stern, without any overhang to counters. Sternpost has a moderate curve and slight rake, while the stem is straight and nearly vertical. Boats of this type are open, carvel-built keel craft (the keel being shallow); straight on top; moderately deep and beamy, the greatest width being aft of amidships. There is a wide seat across the stern for the steersman to sit on, and this is cased in below to form a locker. There are three thwarts, the after one of which is fitted with flanges on each side to make a runway to lead water to the pump, which is placed in the middle of the thwart. The rig is that of a two-masted lugger. The masts are tall and tapering and have a strong rake, the mainmast being much the longest. Two high and narrow, loose-footed, standing lugsails are carried. These are tanned dark red or reddish brown. The following are the ordinary dimensions of a boat of this class: Length over all, 31 feet 6 inches; extreme beam, 10 feet 9 inches; molded depth, gunwale to keel amidships, 5 feet 6 inches; foremast above gunwale, 26 feet; fore yard, 12 feet; mainmast above gunwale, 35 feet 6 inches; main yard, 11 feet 6 inches.

Fishing boat of Concarneau.—A boat with a curious lugger rig is employed in the sardine fisheries from Concarneau, coast of Brittany. It is an open, keel craft with medium sheer; round easy bilge; moderately wide and deep; fine easy lines fore and aft; round stern; stem and sternpost curved and raking slightly; rudder hung outside, its lower end square and flush with keel.

The rig is peculiar, although it resembles somewhat that of the Belgian fishing "sloop." It has two masts. The foremast is short, stands close to the stem, and has comparatively little rake. The mainmast exceeds twice the length of the foremast, steps about amidships, and has a very strong rake aft, its upper end being nearly over the sternpost of the boat. A stay extends from its head to the stem. Two lugsails are carried. The fore lug is small, nearly square, with about one-quarter of it forward of the mast. It tacks down to the stem head, and the sheet trims aft to the gunwale. When sailing close-hauled, the luff of both mainsail and foresail is shoved forward and tightened by a sprit with a crutched end, which ships into a loop or cringle on the edge of the sail.

The mainsail is very much larger than the foresail, and the strong rake of the mast brings its center of effort well aft; so much so that it would appear probable that the boat would gripe considerably when running with beam wind or sailing closehauled. It is loose-footed, tacks down to the weather gunwale, and the sheet trims to the stern. The after end of the yard is much lower than the forward end, giving the sail a strange appearance. It is very much shorter on the after leech than it is on the luff. The mainsail has two reefs, and the foresail one.

Boats of this type have their hulls tarred, and their sails are generally of a reddish-brown color.

They have each a crew of 2 to 3 men, and carry two large oars to be used in calm weather.

The following are the principal dimensions: Length, 30 feet 1 inch; beam, 7 feet 10 inches; depth amidships, 3 feet 10 inches; mainmast, 27 feet 6 inches; foremast, 11 feet 3⅜ inches.

French fishing dories.—Dories, chiefly of American build, have been used by the fishermen of St. Pierre and Miquelon islands for several years, chiefly for setting and hauling trawl lines, and boats of this type are fast superseding the clumsy shallops on some of the vessels belonging to ports in France. The lightness of the dory, the ease with which it can be hoisted out and in from a vessel's deck, its seaworthiness, comparative cheapness, and the fact that it can be managed by only two men, render it preeminently well adapted to the trawl-line codfisheries, and it is not surprising to find that the French fishermen have hastened to adopt it as soon as they have learned its merits.

The dories used by the French are the same in form and construction

FISHING FLEET SAILING FROM DIEPPE.

as those employed in the American fisheries. The former are, however, generally a foot longer than the dories used for the same purpose by American fisherman—that is, the French boats are 16 feet long on the bottom, or about 20 to 21 feet on top. They have one more set of timbers than dories used by fishermen of the United States, and they also differ from the latter in having a ribband, or chafing chock, of hard wood, about 3 to 4 inches wide and ¾ inch thick, which runs from stem to stern around the outside of each gunwale. This, of course, adds to the strength of the boats, but increases their weight, which is the objection to the use of a chafing piece by Americans.

Mud punts.—The men engaged in the cultivation of oysters on soft, muddy areas that uncover at low tide, or who for other reasons

FIG. 266.—Mud punts.

frequent the oozy regions at low water, use a mud punt to enable them to pass over the bottom which will not otherwise bear their weight. This punt is a roughly constructed box-like structure, about 7 to 9 feet long. It is entirely flat on the bottom with vertical sides and square ends. The bow has a strong rake and usually a curve, but the stern is nearly perpendicular. The fisherman has a wooden sandal, about 12 inches long by 8 inches wide, secured to one foot—usually the right foot—and this is used as a paddle to propel the punt over the mud (fig. 266). To do this he kneels on one knee in the punt and vigorously pushes with the other foot, the board sandal enabling him to get a good leverage on the yielding mud that his foot would sink into. A small sail is sometimes used to assist in the propulsion of these punts.

Algerine fishing boat.—Among the models exhibited was one of a fishing felucca from Phillipeville, Algiers (fig. 267). This represented a sharp-ended, carvel-built, keel boat; with low, rather flat floor; stem nearly vertical, but curving outward at top, and with a projecting cutwater or long head; straight, slightly raking sternpost, and round-heeled rudder. It has little sheer, a deep waist and flush deck. There is a large hatch abaft the mast and a similar hatch half way between mast and stem. It has a small cabin aft, and is rigged as a single-masted felucca. The mast steps nearly amidships and has no rake. It is sup-

FIG. 267.—Algerine fishing felucca.

ported by two shrouds on a side, set up by a single whip purchase on each. It carries a large lateen sail and a jib set on a long bowsprit.

The following are the relative dimensions of a boat of this class: Length over all, 38 feet 6 inches; beam, 10 feet; depth, 2 feet 4 inches; mast above deck, 28 feet 5 inches; yard, 53 feet 1 inch; bowsprit outboard, 13 feet 1 inch.

Fishing boats of Tunis.—The exhibit from Tunis included three models of the most important types of boats used in the fisheries of that province. Two of these, at least, are common in the various countries bordering the Mediterranean.

Ox boat.—This type of fishing boat (fig. 268) is used for operating the drag net known as the parenzella, by the Italians, and called "bou net" by the Spanish. The net is towed over the bottom by two boats, one at each end, which sail free from the wind when working together. They are from 35 to more than 45 feet long, and are built more for carrying capacity and seaworthiness than for speed, although the large sail area enables them to make reasonable progress with a stiff breeze, and is specially serviceable for towing the net.

A boat of this kind is a double-ended, carvel-built, keel craft; with

FIG. 268.—Tunis fishing boat.

full, strongly convex lines at bow and stern; low floor; easy bilge; high, curved stem, and curved nearly vertical sternpost. It is straight on top, except at the bow, which rises quickly. The wide rudder hangs below the keel, and to a considerable extent acts as a centerboard. The boat is decked, with a large hatch abaft the mainmast, one small hatch aft on the starboard side and another well forward on the port side. It has several stout stanchions for tow ropes, and carries a four-pronged anchor. It is felucca rigged, and carries a single large lateen sail.

Its relative dimensions are as follows: Length over all, 45 feet; beam, 16 feet 3 inches; depth, 6 feet 10 inches; large hatch, 6 feet 10 inches by 6 feet; mast above deck, 31 feet 3 inches; yard, 53 feet 2 inches; rudder extends below keel, 3 feet 8 inches; the sail measures 51 feet 10 inches on luff, 45 feet on leach, and 30 feet 7 inches on foot; oars, 18 feet long.

This boat is of the type known as "bateau de boeuf," or ox boat, a name given to it because it always works in pairs in dragging a net, and thus has a fancied resemblance to a pair of oxen attached to a plow.

In referring to this type of boat, used from the Gulf of Lyons, Admiral Paris affirms that it carries a crew of 16 to 18 men. "These vessels," he says, "never take any reef, and when the wind is too strong they set a jib named 'maraboutin,' tied upon the smallest of two spars which they have on the deck, and of which the length is 12.50 meters, whilst that of the second spars, named 'penon du coutelas,' is 15.28 meters."

They are ballasted with gravel, and they have no grapnel to use when they enter port. They have four oars of about 10 meters length.

These boats are painted black with a white, red, or green stripe 0.20 meter wide from the back rabbet at the level of the deck to within 1.50 meters of the stem. Upon the crosspiece of every deck is painted the letter A for Adge, C for Cette, and M for Marseille and Martigues. At the side is a white number 0.40 meter high. The stem, the stern-post, and the rudder are black like the rest of the boat.[1]

Tunisian fishing boat.—This type of boat (fig. 269) is extensively used in the general fisheries of Tunis, and closely resembles in form and rig the feluccas used by the Italian coral fishermen. It is a double-ended, carvel-built, keel boat, with straight, vertical stem and stern-post above water but curved below. It has a low floor; round bilge; is full at the rail, with much sharper, hollow lines at and below the water line. The rudder extends below the keel. It is decked, with a large oblong hatch in the middle of the deck extending forward and aft of the mast, which rakes strongly forward. It is rigged as a single-masted felucca, and carries a large lateen sail and small jib.

The relative dimensions are as follows: Length over all, 43 feet 9 inches; beam, 16 feet 3 inches; depth, 6 feet 3 inches; hatch, 16 feet 9 inches long by 6 feet wide; mast, above deck, 22 feet 6 inches; yard, 45 feet 3 inches; bowsprit, 7 feet 7 inches; rudder, below keel, 18 inches.

Sponge-fishing boat.—A carvel-built keel boat of a Grecian type is used in the sponge fisheries of Tunis (fig. 270). It has a sharp bow; straight vertical stem; low floor; round bilge; long easy run; square stern, without overhang; square-footed rudder, and symmetrical sheer.

[1] Souvenirs de Marine, by Admiral Paris, vol. 1.

It has a timber across the stern, with its ends curved up sufficiently to hold the sponge hooks, which can be temporarily laid on them, although these are usually laid in rests on the gunwales when fishing is not going on. It is decked, with the exception of a large open space amid-

FIG. 269.—Tunis fishing boat.

ships for stowing the sponges and for the oarsmen to stand in. The oars have elongated, fan-shaped blades and square looms. A three-pronged spear, resembling a grains, with a long handle, is used for collecting sponges. The relative dimensions of the boat are as follows:

FIG. 270.—Sponge-fishing boat.

Length over all, 35 feet 10 inches; beam, 11 feet 10 inches; depth of hold, 4 feet; oars, 15 feet 10 inches; sponge hooks, 32 feet 6 inches and 35 feet 10 inches; open space, 11 feet long, 6 feet 8 inches wide. The model exhibited at Bergen had neither mast nor sail, but was

provided with mast hole, showing that boats of this class usually carry sails.

Fishing apparatus.—Several firms or individuals exhibited specimens of fishery apparatus of various kinds, but the collections were limited and the entire exhibit of appliances of this kind was not imposing.

Nets.—The nets exhibited were machine made and generally of good quality. Sardine nets were apparently most numerous. These are made of fine linen twine, with a 1¼-inch mesh.

The herring and mackerel nets are similar to the same forms of apparatus used in neighboring countries fishing in the same waters. Beam trawls and otter trawls are also essentially like those of Great Britain. The drag seine is quite generally used in France and its dependencies, but differs in no essential particulars from those described.

Trammel nets are used to a considerable extent in Tunis. The drift nets for pilchards and anchovies are 82 fathoms long and about 3 feet deep. The mesh of the former is 0.7 inch (bar measure), and the mesh of the anchovy nets 0.6 inch.

Bou net.—A kind of trawl net, which is operated by two boats—the "bateau de bœuf"—is used in Tunis. A model of this was exhibited. This consists of a purse-shaped bag in the center and two long wings. The upper part of the net is supported by floats along the cork rope of the wings and bunt, and the ground rope is kept to the bottom by sinkers sufficiently heavy to overcome the buoyancy of the floats. These nets vary materially in size, the dimensions depending on the size and power of the boats that use them. Following is a description of one of them: The arms are 130 meshes, or about 3½ fathoms deep and 7 fathoms long, the cork rope and the ground rope having nearly the same curve. The body of the net from where it is joined by the wings tapers so as to form a conical sack 5½ fathoms long, which is joined by a small neck to the end, the extremity of which is flat and spread considerably. This end corresponds to the "cod" in a beam trawl. To the end of each wing is attached a towing span, a double rope, distended in the middle by a wooden spreader or crossbar, one bight of which is secured to the extremity of the wing and the other bight having an eye for the wing rope to bend into. I am informed that these nets are used in various depths up to 100 fathoms in the Mediterranean, and that the towing warps are sometimes 300 fathoms long. The boats keep apart 400 to 500 fathoms when towing, so that the arms of the net will spread and sweep a wide area of sea bottom.

One of these nets has a total length of about 180 feet; length of each arm, 42 feet; width of arms, about 21 feet; size of mesh in arms, 2 inches; in body of net, 1 inch and ¾ inch. Lead sinkers about 1 pound each, and 18 inches apart on the ground line.

Shrimp nets.—The large dip nets used for catching shrimp along the shore (fig. 271) have a wooden frame shaped like the letter T, the lower part being the handle, and the crosspiece or head serving to distend the net, and also being of the proper form to closely follow the bottom, where the fishery is prosecuted. The handle is usually about 8 feet long, and at the end opposite the head often has a knob that holds the line from slipping, which passes around the shrimper's neck, and assists him in guiding and working his net. The flat wooden head is 6 or 7 feet long. A little more than half way down the handle is a short crosspiece of wood, varying from about 20 inches to 3 feet in length. Sometimes this is rigid, but frequently it is tapering and somewhat flexible, so that it bends like a bow. Usually its ends are supported by stays running back to the handle. The rear end of the

FIG. 271.—Shrimp fishermen and nets.

upper edge of the net is bent to this crosspiece, while the straight front edge is attached to the inner side of the head, so that the net will not be chafed or injured when the apparatus is pushed along the bottom.

The net itself is a fine-meshed fabric, and deep enough to form considerable of a bag, sufficient to hold the shrimp and prevent their escape when once they are swept into the net.

Pound nets, traps, weirs, etc.—Several models of different kinds of pound nets, or fish traps, were exhibited in the Tunis section by the general director of public works. One of these, called "bordique," is a form of pound net, or weir, having a leader from each side, with a sort of double heart, the inner one having three long points, with a bowl or pound at each point of the triangle (fig. 272).

A form of fish weir is shown in figure 273. The leaders and wings of this weir are made of brush or sticks, stuck into the bottom. The hearts, which differ in size, are made of slats firmly lashed together and securely fastened to stakes, each of which is held by an anchor, but each corner stake at the entrance to the heart is held by two anchors. At each of the two angles of the larger inclosures, at the ends of the main leader, is a wicker fyke into which the fish find their way, and are ultimately captured. The small wing heart has only one fyke. The positions occupied by the boats while waiting to "fish" the weir were shown on the model.

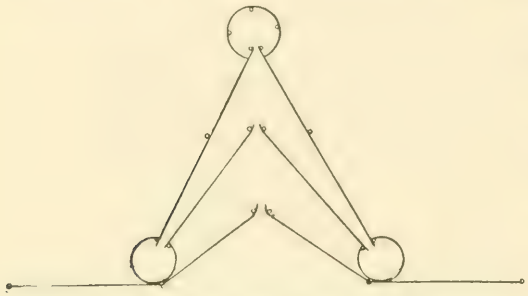


FIG. 272.—Plan of pound net. (Drawn by W. H. Abbott.)

A model of a tunny trap, or "crawl," was exhibited. This is the kind used in nearly all parts of the Mediterranean, where the tunny fishery is prosecuted with fixed apparatus. The general plan of this

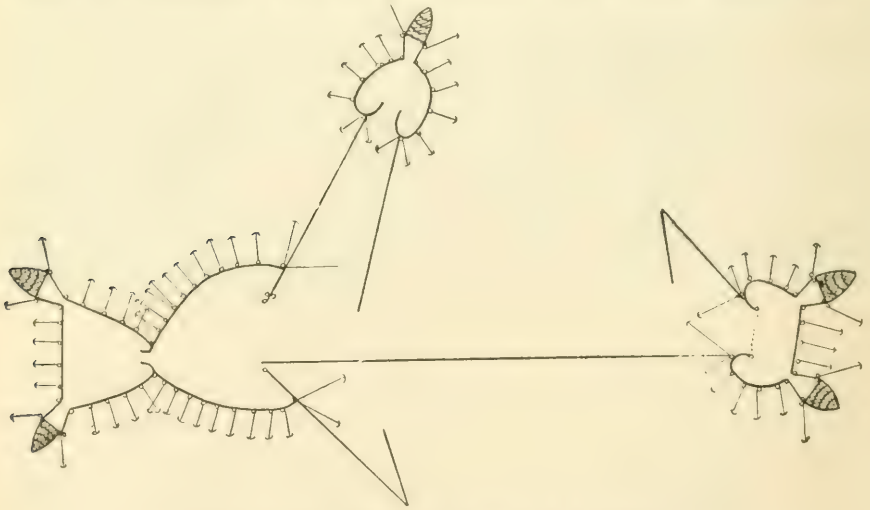


FIG. 273.—Plan of fish weir. (Drawn by W. H. Abbott.)

is shown in figure 274. This trap consists of an oblong inclosure, with an opening in the center of one side and a long leader extending from one side of this opening toward the shore. The fish are supposed to approach the crawl from one direction only. On the outer corner of the inclosure, on the side of approach, is another leader placed at the proper angle to direct the fish toward the inner leader, and thus into the trap.

One wing of the crawl is divided into two sections, or rooms, by nets, and the other into four compartments.

One of these tunny traps, called "thonaire," is situated in or near the creek of Sidi-Daoud, a short distance from Cape Bon, where a concession has been granted to Count Raffo.

"This tunny fishery, or 'madrague,'" says M. Bouchon-Brandeley, "essentially consists of a long line of nets, perpendicular to the shore. The nets braided with alfa strings have very large meshes, from 30 to 35 centimeters wide; they run from the shore to a distance of 2,000 meters off; at the end of this long wall, and perpendicularly to it, is opened a first square room 50 meters long on its side. This room communicates with a series of five similar rooms by some breaches, or clefts, which may be easily shut or opened at will. All these rooms are made of alfa strings and lead into a central cage, called 'matance'—

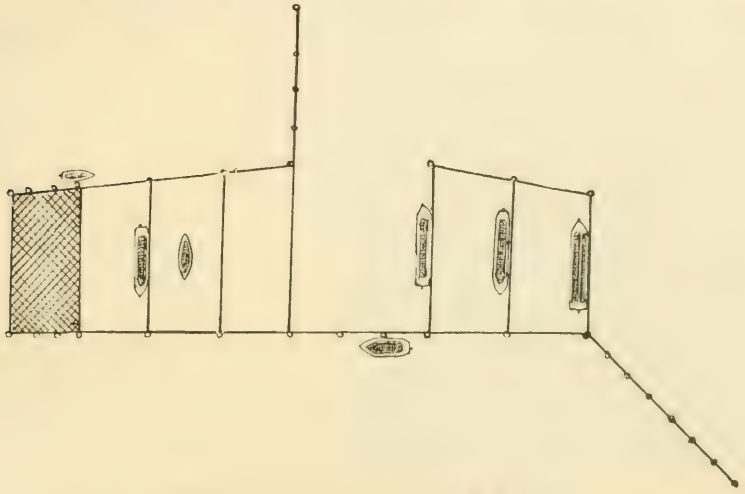


FIG. 274.—Tunny trap. (Drawn by W. H. Abbott.)

that is to say, the death room—the last cell of the condemned prisoner. This last room is braided with hemp thread; besides, it is provided with a hemp-braided bottom, a sort of floor or ceiling that may be raised up or down at will.

"These heavy nets are vertically spread by means of large cork bundles floating on the surface, while heavy stones and a series of 120 iron anchors fix them at the bottom. They are impassable barrage [barrier], half a league long and 32 meters high at least.

"The working of this apparatus may be easily understood: the tunny fishes coming from Goletta and going to the north meet with this bar and, unfortunately for them, they don't try to shun danger by going back; they follow the line, the head close to the net, and by this way they are led to the entrance of the first room, into which they unhesitatingly penetrate.

"Then they do not cease whirling until, by their turning round, they happen to pass before the second room, which they unhesitatingly enter. Then the fisherman can consider the tunny as being at their mercy, whether the fishes go farther into this mazy network or they come back.

"Fishing is not allowed unless 500 or 600 fishes are gathered, the very bad years excepted. Sometimes 1,000 fishes come together, and in that case the work is divided into several fishings by distributing the prisoners in the rooms at the outside of the 'matance' room and taking them again from these rooms at the right time."[1]

Trawl lines.—The trawl lines used in the cod-fishery are now often similar to those of New England, except that hemp line is largely, if not exclusively, employed in their construction. The comparatively small, center-draft eyed hook has largely superseded the angular, galvanized hook, which straightened when a fish was slat off it and had to be bent into shape on a "former" before it could be used again. While the latter may still be used more or less extensively on trawl lines, the greater effectiveness of the American pattern of hook is now pretty well understood by many French fishermen.

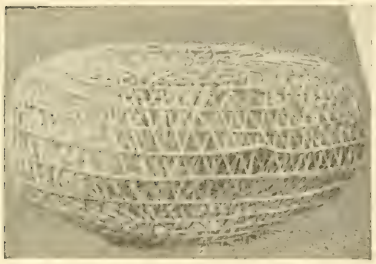


FIG. 275.—Fish pot.

The trolling lines used in the tunny fishery will be referred to in the discussion of the fishery.

Spears, etc.—The three-pronged spear used at Tunis for gathering sponges has been alluded to in the description of the sponge boat. The spear itself has three straight barbed points like a grains, and is fixed to a light wooden handle between 30 and 40 feet long. The models exhibited represented spears 32 feet 6 inches and 35 feet 10 inches long.

Pots.—A low, circular fish pot resembling a common sea urchin (*Echinus esculentus*), with a funnel-shaped entrance at the top, is used in Algiers for catching various species, especially *Pteri gigas*, *Sparus melanurus*, and *S. sargus*. Sardine offal is used for bait. This pot is made of reeds fastened to small withes (fig. 275). It has a door on the underneath side 7¾ inches wide. It is 19½ inches high and 4 feet 8 inches in diameter.

A large conical basket made of rattan (fig. 276) is used in Algiers for catching a variety of fish, including sardines. It has a funnel-shaped entrance at the larger end, and a door or cover at the small end for taking out the catch. It is 4 feet 11 inches long, and 4 feet 1 inch greatest diameter.

[1] Tunis at the International Fishing Exhibition of Bergen. Pp. 34–35.

A three-pronged iron rake with curved teeth and long wooden handle is used in gathering seaweed in the surf, which is an industry that employs a large number of the coast population of France. Women are chiefly engaged in this work.

A three-pronged pitchfork of the conventional pattern is commonly used for handling the seaweed after it is landed.

The handbarrow upon which the seaweed is carried from the beach to the adjacent land, where it is spread to dry, is almost precisely like that used in New England in curing cod, etc. It consists of two slightly recurved handles, united by five crossbars. Those on the outside are flat and the three middle ones are round.

Coral apparatus.—The apparatus used in Algiers and Tunis for taking coral consists of a wooden cross, weighted in the middle with stone or lead to keep it at the bottom. This is called St. Andrew's cross (Croix de St. Andre) by the fishermen. A lot of swabs (bunches of loose hemp rope-yarns) are attached to the bars of the cross, and sometimes, it is stated, nets, the meshes of which are loose, are fastened in the same manner. The device is dragged over the bottom, and the long loose yarn or nets sweep in and out among the crevices of the rocks, and wind about the branches of coral so firmly that they are broken off and thus secured. The apparatus is raised at intervals, the length of which usually depends on the fishermen's judgment as to the time required to obtain a satisfactory catch.

FIG. 276.—Fish trap.

Accessory appliances.—The French exhibit was notable for collections of apparatus and implements of precision more or less accessory to fishing, such as instruments for navigation, meteorological observations, etc. The construction and purpose of these are, however, so well known that only brief reference to them will be made.

Light-house lens and lanterns.—The firm of Barbier & Barnard, of Paris, had an excellent display of various sizes of multiradiant lenses for light-houses and lanterns. The largest of these was of the class designed for a high order of light-houses, and was fitted with machinery to keep it continuously in motion, in order to illustrate its movements when used for a revolving or flash light.

Sextants, spyglasses, barometers, etc.—Hurlimann, of Paris, exhibited sextants and octants. In the manufacture of nautical instruments, especially sextants and octants, that can be sold to fishermen at a moderate cost, the French have shown a laudable desire to meet the requirements of a class of seafaring men who can not afford to pay high prices. I examined some of these instruments, and while they lacked the expensive fittings of the costlier implements, they seemed to be well made and to possess all the elements necessary for safe navigation.

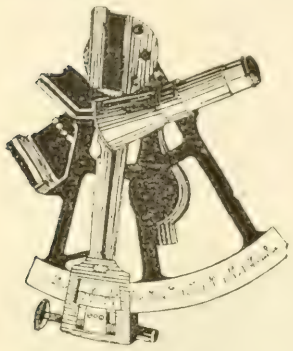


FIG. 277.—Octant.

A small octant exhibited by Hurlimann (fig. 277) sells for 90 francs, or, approximately, $18. It is said to have all the accuracy and reliability of the highest-priced implements, and is recommended to fishery schools and to scientists who have need for such instruments. It is considered specially adapted to the requirements of fishermen who may need to determine their positions at sea and who might be indisposed or unable to pay the prices heretofore charged for metal instruments of this kind.

The chief feature of this octant is that white metal is used in its construction; this serves the same purpose as silver for the arc and is less costly. It has, however, less colored glasses than a sextant, but the manufacturers think there are enough for the purpose.

Various forms of marine and field glasses and opera glasses were exhibited. Some of these were of ordinary patterns and others are new forms, or at least of recent date.

Among the former may be included the marine glasses (fig. 278) adopted by the French navy, but it is claimed that the new form of glasses (fig. 279) used by the French artillery officers are remarkably powerful.

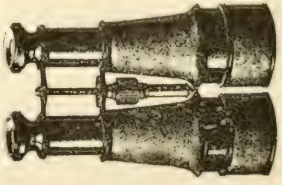
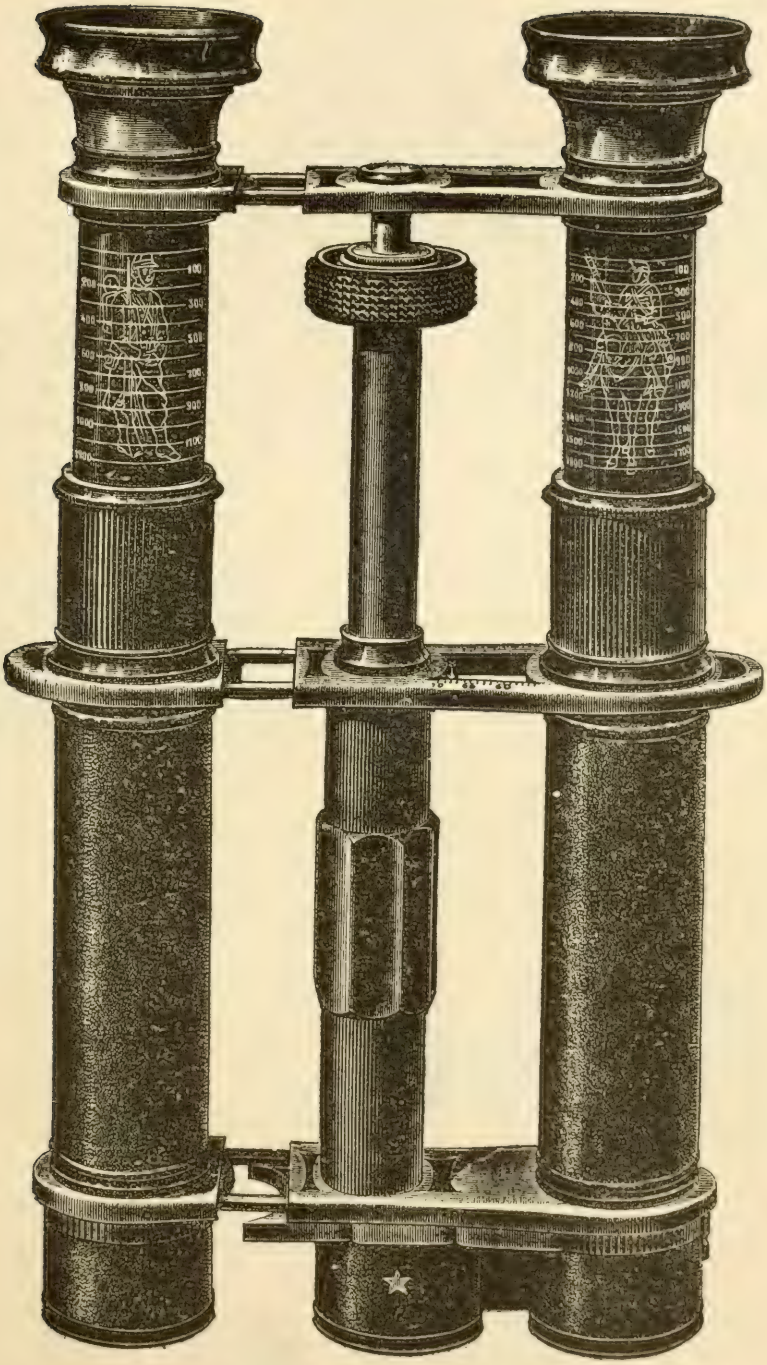


FIG. 278.—Marine glasses.

A new kind of field glass (fig. 280), the so-called "Jumelles stereoscopiques," is remarkable for the principle of its construction as well as for its power. On several occasions I had the opportunity to test its merits and found it extremely satisfactory. It derives its name from the fact that in using it objects at a long distance stand out in bold relief, like those seen in a stereoscope, and therefore are clearer and more definite than when seen with ordinary glasses or with the naked eye, except when near. This result is due to an arrangement of glasses and reflectors, so placed in relation to each other that one does not look directly through the glass at the object, but the latter is so reflected that it is seen clearly.

The "stadia-telemeter" (Pl. LV), of which examples were exhibited,



STADIA TELEMETER.

is specially designed for measuring distances with accuracy. Such an instrument as this would doubtless prove very serviceable to seamen in accurately determining the distance of land, buoys, or other objects which serve to guide a vessel safely through intricate channels if the exact distance from them can be learned. But if it can be made to quickly and accurately measure the distance of a vessel from land when it exceeds 3 miles, it might prove of great value to fishermen in determining their exact position in relation to the shore, when fishing off foreign coasts which they are not allowed to approach, for the purpose of fishery, within a specified distance. Other forms of the telemeter are made, resembling in appearance the ordinary field glass, while one is like a spyglass. The one figured, however, seems to be the latest and most approved type.

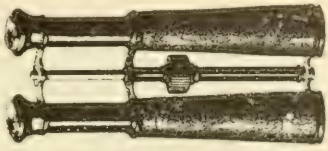


FIG. 279.—Artillerist's field glasses.

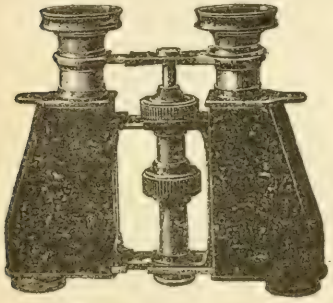


FIG. 280.—Field glasses.

Meteorological implements.—Various kinds of electrical instruments for recording meteorological observations were exhibited. Among these were several forms of anemometers, fixtures, and registering devices, registers for barometers, thermometers, hygrometers, etc. Some of these are shown, but it seems inexpedient to enter into a detailed technical discussion of such highly specialized implements in this report, since they are only remotely associated with the prosecution of fishery. The following explanations may suffice:

The apparatus with cup-shaped disks is a common device for transmitting the velocity of the wind by direct mechanical action. Figure 282 transmits mechanically the force and direction of the wind, which are registered on the anemometer-anemoscope shown.

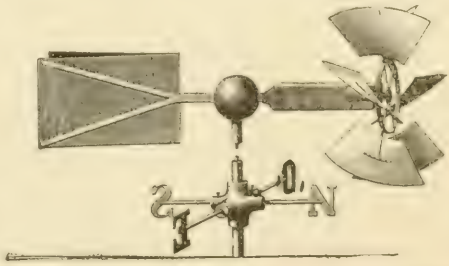


FIG. 281.—Mechanical transmitter. (From French print.)

Another form of anemometer-anemoscope registers four directions, and Girouette's electrical receiver is credited with recording 128 directions. Various other devices for recording the velocity of wind were represented. The exhibits of barometers included several well-known varieties, and also registers for recording variations of pressure. The register shown in figure 283 is fairly representative of this class of exhibits.

Methods of fishing.—The methods by which certain branches of fishery are prosecuted were illustrated by photographs and paintings.

The cod fishery was not represented, but it may be said that the French method of operating trawl lines is generally similar to that adopted by New England fishermen, especially if dories are used. The French fishermen who frequent the fishing banks of the western Atlantic come directly in contact with American fishermen, with the result that the former have found it to their advantage to adopt not only the dory and hooks used by New Englanders, but also the same system of setting and hauling lines. Those, however, who still persist in using the old-fashioned lugger—bateau de peche—have a different method of setting and hauling trawl lines, due to the larger size of the boat and the consequent inability of a vessel to send out more than two or three of these luggers. Thus, instead of each line being run out straight from the vessel, as is the case when dories are used, a lugger carries five or six miles of line or more and sets it in a triangle by sailing off from the ship nearly close-hauled for a certain distance, putting out line all the way, then to leeward, and finally back toward the anchored vessel. The throwing out of the line is so gauged that the last end of it is put over near the ship. The manner of hauling has been alluded to in the description of the lugger.

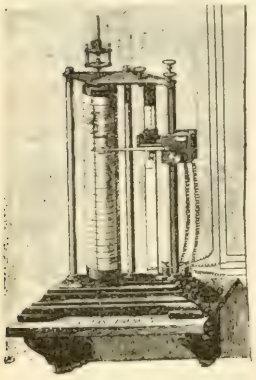


FIG. 282.—Register. (From French print.)

The method of beam trawl fishery on sailing vessels is practically the same as that of the English. This I have fully described in "The Beam Trawl Fishery of Great Britain," published in the United States Fish Commission Bulletin for 1887, and reference is made to that paper for detailed information.

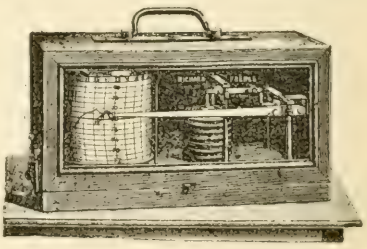


FIG. 283.—Barometer register.

The system of trolling for tunnies is interesting and has all the elements of sport (Pl. LVI). When trolling, a lugger has a pole thirty or forty feet long extending from each side at right angles to the vessel. This is supported by lifts, and is held in position by guys extending to the bow, and also to the rail amidships and aft. The pole on the lee side is usually raised considerably higher than on the weather side, the angle depending on the strength of the wind and the consequent angle of heel of the vessel. There are five or six troll lines from each pole. These lines are provided with leaden sinkers which keep the hook at the requisite depth, even in a fresh breeze, for

TUNNY FISHING.

Drawn by Jean Connerre.

the fishing is generally best when the luggers are sailing fast. What may be designated as a hauling line, one end of which is on board the lugger, is bent to each of the trolling lines several fathoms from the pole. This hauling line is indispensable, for when a tunny bites, a fisherman pulls in the bight of the trolling line, and thus quickly brings the fish on board. When fish bite freely, the work is often exciting, and the men are kept busy pulling in the lines and bringing on board the gamy and active tunnies. If time permits, the fish are beheaded, and often they are hung over the stern to bleed.

Among the novel features of the fisheries represented by France is the method of notifying the owners of vessels or large packers of the catch of herring or other fish by means of carrier doves. It is

FIG. 284.—Using a carrier dove.

considered important by packers to have timely notice of the catch, particularly if it is large, so that provision for its care can be made before the arrival of the fleet. To secure prompt notification while the fleet is still at sea, a fishing vessel may take one or or more carrier pigeons when it sails. If the morning haul of the nets results in a good catch, so that the vessel will sail for market, a message is fastened to a pigeon (fig. 284) and the bird is set free to seek its home, where its arrival is looked for by those detailed for the purpose.

The drag seine fishery differs in no essential particular from that of other countries, except that women participate in it. The seine is set in a semicircle with a line from each end to the shore. The net is dragged to the beach by these lines. If the shore recedes gently, so

that the water is shallow, it is not uncommon for men and women to wade out some distance to pull on the lines. The method of hauling a seine at Rochelle is shown in Plate LVII.

As has been indicated, the gathering of seaweed is an industry of some importance in France. Women participate in the work very largely, and, according to a painting by Jean Connerre (fig. 285), monopolize it in some localities. Armed with long-handled rakes, they stand at the edge of the surf or wade out into the water, and by a dexterous use of their rakes they draw to the beach the algæ, which is a laborious and trying occupation, especially for women, and the greatest amount of endurance and hardihood are necessary to sustain the tax upon the vitality of those who engage in it.

The following notes on the sardine fishery have been largely sup-

FIG. 285.—Women gathering seaweed. (Drawn by Jean Connerre.)

plied by a prominent French packer, but to some extent have been extracted from a report on the Sardine Fishery of Brittany, made to the State Department of the United States by Consul De Sallier-Dupin:

The catching and preservation in oil of the sardine is one of the most important industries of Brittany. Along the coast from Les Sables d'Olonne (Vendee) to Camaret (Finistere) there are about 150 canning factories. During the sardine fishing season, which lasts about five months, 2,500 boats, equipped by from 12,000 to 15,000 sailors, are employed. The employees of the factories number about 10,000 women and children, and from 1,500 to 2,000 men. The annual expenditure of labor, material, etc., amounts to about $3,875,000.

This industry originated at Nantes in the year 1834, and some of the best brands are still those of that city. These brands are imitated in Spain and Portugal, but are of inferior quality, owing to the use of Spanish instead of Italian oil.

The sardine is a migratory fish, which first appears on the coast of Africa, passing northward in large shoals, following the coast of Portugal, crossing the Bay of

HAULING SEINE AT ROCHELLE.

From French drawing.

Biscay, and striking the coasts of Vendee in the month of April or May. Here the sardine is met by fishermen stationed in the seaport town of L'Isle-d'Yeu and in the bays of the Sables d'Olonne and of Saint Giles, who assemble from all parts of Brittany and follow the fish toward the north, retarding its progress with a special bait called "roque."

The season for sardine fishing on the coast of Brittany usually begins about the middle of May and continues until the end of October.

The success of the fishery varies materially, and it has not yet been possible to determine the causes of the fluctuations in abundance of the fish. However, it is generally admitted that after a mild winter the fish appear earlier and are more plentiful than after a season of severe weather.

The boats used for sardine fishing are open, double-ended, lug-rigged vessels, about 32 feet long, and those sailing from Douarnenez are generally manned by 5 or 6 men (Pl. LVIII).

The nets used are much like those employed in Spain, known there under the name of "xeito." These are gill nets, and the sardine is caught by being entangled in the meshes. Each net is from 450 to 500 fathoms in length and about 9 feet wide. The nets are barked or tanned, and are dark colored and sometimes nearly black. Along the upper part are cork floats, and on the foot line are leaden sinkers to keep the net in an upright position in the water.

The bait is an important feature of the sardine fishery, since it is quite expensive, and the fishermen often use quantities without securing any satisfactory result. It is made chiefly of cod roe (and, according to some authorities, of mackerel roe also), which is generally imported from Norway, and is technically known as "roque." It is claimed by some that mackerel roe is superior for this purpose. The roe is mixed with clay, and so prepared the bait costs from $7 to $17 per barrel. This bait is made into small balls and thrown into the water, where it slowly dissolves and scatters as it sinks.

The method of fishing is substantially as follows: The fishing takes place rather near the land, and most frequently at or about sunrise. Before daybreak the boats leave port to search for the schools of sardines; many leave in the evening and anchor at sea. When a peculiar bubbling of the water reveals the presence of fish, the nets are immediately thrown out. The oarsmen row either against the wind or the tide. One man casts the net as the boat advances, while another throws bait into the water to attract the fish.

At nightfall the boats return to port, where they sell their fish to the canners at prices varying according to the abundance of the catch and the size and freshness of the fish. Sales are made by the "thousand," but this term does not always indicate a thousand sardines. For example, at Belle Isle 1,240 fish make a thousand. Factories for

preserving sardines are located at all the ports, for the fish spoil easily and can not bear transportation. The fishermen convey the sardines to the factories in baskets.

The method of preparation is as follows: The heads and entrails are first removed, and then the sardines are spread on the floors of the buildings and salted. They are allowed to remain under salt from half an hour to two hours, according to the size of the fish. They are then thoroughly washed in clean water and dried on screens, hurdles, or wire gridirons. This work is done almost entirely by the wives and children of the fishermen, whose wages, added to the earnings of the men and boys, enable the families to subsist during the following winter.

After the fish have been thoroughly dried, they are cooked by plunging them into boiling oil heated to 100° C. (212° F.), by boiling them with steam at the same temperature, or by putting them into a heated oven. Thus there is obtained, according to the process used, fried, boiled, or broiled sardines. The last two methods of "processing" are cheapest, and the fish is, perhaps, whiter. But the first method—the dipping of the sardines into boiling olive oil—though costlier than boiling or broiling, gives much better results so far as flavor is concerned, and is, therefore, largely adopted. The oil used is imported from the province of Bari, Italy.

When cold and thoroughly drained, the sardines are handed over to workmen who pack them in rows in small tin boxes, which are filled with pure olive oil, and then passed to the tin men, who solder them. The boxes are next thrown into hot water, where they remain from one and three-fourths to nearly three hours, according to the size of the boxes. When withdrawn from the bath, the boxes are first cooled and then rubbed with sawdust to cleanse and polish them, after which they are packed in wooden cases of one hundred boxes for shipment.

During their immersion in boiling water oil will escape from boxes not properly soldered. In such cases the loss is sustained by the solderer. A good workman rarely misses more than two or three boxes per hundred.

A quality of sardine called "boneless sardines" is prepared especially for the New York market by factories at Concarneau and Douarnenez. Their preparation requires special care, and they command a high price.

Sardines in oil are sometimes mixed with truffles. They are also prepared with tomatoes and sent in small quantities to the New York market, but the chief export in this form is to Mexico. Sardines are also preserved in butter and vinegar. Those preserved in butter are good. As the butter is generally of inferior quality, it is necessary to remove it from the sardine before serving. Another inconvenience is that the box must be heated to melt the butter, so that the sardine can

be removed entire. Sardines preserved in vinegar are required to be washed before using. The addition of oil renders the fish more palatable, though the sardine retains the taste of the vinegar and its flavor is partly destroyed.

It is easy to understand how much the quality of sardines may vary because of the kinds of oil and fish used. Those manufacturers who are willing to offer under their brand only such products as are entirely faultless, buy fish exclusively from boats having only a moderate catch and which come into harbor early to land their fares. Thus is avoided a too great piling up of fish, and also a long exposure to the sun. This is a very important point in the obtainment of first-class material, and the chief point in summer. Of course it follows that the fish obtained under such conditions are much dearer than those purchased of boats which have taken great quantities of sardines.

The obtainment of good olive oil is within the reach of everybody, and its procurement is only a question of price. Therefore, by carefully choosing the best quality of fish and oil without regard to the cost, anyone has in his hands the means to secure the best results in packing. As a matter of fact, however, all manufacturers do not know how to avail themselves of these opportunities, or at least do not choose to go to all the expense that is necessary.

In order to obtain a faultless result, it is of the highest importance that the various stages of the work should be so regular or systematic as to follow each other as speedily as possible, and invariably to take place under the same conditions. Above all, it is absolutely necessary that the fish should be perfectly dry before they are cooked; that they should be cooked without any carbonization, and always at the same temperature.

Until lately the sardines were dried in the open air, which required more or less time, according to the weather. Sometimes two hours were sufficient, but at other times the sardines had to be kept for a whole day or more without being dried, and often they had to be cooked before they were perfectly dry. Many factories, it is claimed, have not improved upon this method. Some of the manufacturers still make use of coppers heated by direct fire, in which, beside the danger of carbonization, which quickly makes the oil black, there are liable to be considerable variations of temperature.

Referring to this matter, M. George Ouizille makes the following statements regarding improvements in drying and cooking sardines:

We have entirely regulated our production by drying the sardine by means of an apparatus called "aéro-condenseur," which is not of our invention, but which we have improved, and by cooking in special coppers known under the name of "Lagillardaie coppers," which makes possible the obtainment of a uniform temperature without any carbonization.

Here is a succinct description of the apparatus:

Drying apparatus.—The principal apparatus is the aéro-condenseur. This is com-

posed of a set of vertical pipes set in two plates of sheet iron, on which are screwed hollow half spheres of cast iron so as to form at each end of the pipes a chamber into which they all open. A specially powerful ventilator throws a current of air on the outside part of the pipes. Steam is brought through the tubes into the upper chamber and is distributed in the vertical pipes, where it is condensed under the action of the current of air. The condensed water gets into the lower chamber, from which it is taken out through a pipe arranged for that purpose. The air, heated by its contact with the pipes, is distributed by means of an opening provided with slides, by which it is regulated so as to obtain the requisite temperature.

With this apparatus, the heating and ventilation can be varied at will, and once regulated, they keep in perfect adjustment, which makes it possible to constantly maintain the degree of temperature required. The use of this apparatus is advantageous because it excludes dust and smoke, prevents escape of steam, and removes any danger of fire.

In drying sardines it is necessary to evaporate from the fish a certain quantity of water. Therefore it can easily be understood that, by regulating the arrival of steam in the pipes, on the outside of which a current of air is thrown with more or less strength by the ventilator, it is possible, whatever the weather may be, to obtain a perfect and uniform result in drying.

The aéro-condenseur is continued or extended by a chamber into which trucks carrying gridirons full of sardines enter through a door, and these occupy successively their respective positions, and pass out through another door, so that each of the trucks remains exactly the same length of time in these several positions under conditions that are precisely similar. The sardines are cooked immediately after they are removed from the drying chamber.

M. Ouizille also furnishes the following interesting statement concerning an improvement in a vessel for cooking sardines, which he designates as "copper for cooking:"

During the operation of cooking, the sardine leaves a residuum, or waste, composed of oil, grease, blood, scales, or loose sections of flesh. The grease and blood may be pure or mixed with water. In the coppers ordinarily in use all this waste, being heavier than the oil, sinks to the bottom of the kettle and adheres to the sides, which are exposed to the action of direct fires, so that numerous points at the bottom are incessantly exposed to very high temperatures, which produce the carbonization of the waste, and subsequently of the oil in which the fish is boiled. Carbonization gives to the waste and oil a most unpleasant taste, which is soon diffused in all the bath by boiling, for this quickly mixes the contents of the copper.

We avoid these disadvantages by dividing the bath into two zones—the upper one composed of olive oil heated by means of pipes through which steam passes, thereby insuring a continuous and uniform temperature, and a lower one composed of water that is not exposed to the action of the fire.

All the waste material resulting from the cooking of sardines, because of its weight, sinks to the bottom of the copper. Thus it no longer spoils the oil, and carbonization is rendered impossible.

The bottom of the copper at one end is considerably lower than at the other end, the apparatus thus having a form which permits all waste material to collect on one side, from whence it can be easily removed. For cleaning it, the oil is drawn out through a tap, then the waste and water is drawn out through another tap. After this the copper is thoroughly washed out. By this means the serious disadvantages resulting from carbonization are completely avoided.

The most important thing in connection with sardine canning is to be able to produce a good article for the trade without variation.

SARDINE FISHING

Drawn by Jean Connerre

A large quantity of sardines in oil, as a rule of good quality and medium size, is exported to the United States. They are generally put in quarter boxes, designated as "quart bas" and "quart américain." The quart bas contains from 10 to 12 fish; the quart américain from 12 to 18. The exports by the canners during the year 1892 were as follows:

Nantes	$334,630.02
Brest	28,664.01
L'Orient	62,854.33
	426,148.36

These figures do not represent the actual exports, for many canners sell to commission houses at Paris, Bordeaux, Havre, London, etc., who ship to the United States and other countries.

Coral fishing.—The operation of the device called "St. Andrew's Cross," described elsewhere, is very hard and laborious work, requiring not only strength, endurance and skill in towing, but a thorough knowledge of the areas of sea bottom where the fishery is prosecuted, which is generally in depths varying from 13 to upward of 40 fathoms. The upper end of the towing warp, to which the cross is bent, is around a capstan on the boat that is used to heave up the apparatus at the proper time. In towing the cross, the object is to have it attain "an upward motion," so that the wood will rub or drag safely over the rough madreporic reefs, in the openings or crevices of which the coral is chiefly obtained. The boat proceeds slowly, so that the threads of the swabs may have time to float or sweep around the coral branches, and so entangle them as to make capture possible. The skipper of the boat keeps his hand continuously on the hawser, and long experience enables him to determine, by the vibrations of the towline, "whether the stopping of the swabs comes from a rocky prominence or a coral bunch." When it is supposed the catch is sufficiently large to warrant it, or at least towing has continued long enough, the skipper orders the crew to heave up the apparatus, which they proceed to do by getting the capstan in motion.

The Italians, and sometimes others, surreptitiously prosecute a so-called "grasse" fishery for coral, in which they use an unlawful device that is similar in form to the other, but is "armed at each end of its extremities with strong, iron, sharp-edged hoops, upon which 'large woof sacks' are hanging." This is operated the same as the other. The difference is, however, that when the arms of the cross come in contact with the base of corals on the rough bottom the iron armor is so powerful that it wrenches the coral away, and sometimes even the stone upon which it grows is broken. This is considered a very destructive and undesirable method of fishery, because it tears away the stumps or bases upon which the branches develop, and thereby causes a cessation of growth, and consequent barrenness of fishing grounds. For this reason, the use of this device has been prohibited.

Sponge fishery.—The fishery for sponges in Tunisian waters is most actively prosecuted from October to the close of January, and is participated in almost wholly by the fishermen of neighboring countries—Greeks, Maltese, and Italians—who at the proper season swarm into the Gulf of Gabes in large numbers. A great fleet of boats and as many as 5,000 people assemble at the fishing stations at this time. The fishery is carried on by different appliances and methods. Some of the native fishermen wade along the shores and "fish on foot" for such sponges as can be gathered in this primitive manner.

A fisherman goes out until the water is up to his neck, when he moves slowly along, feeling carefully with his feet for sponges, the presence of which experience has taught him to quickly detect. If a sponge is felt, it is detached by the fisherman's toe, and is sent toward the surface by an upward kick, when it is grasped by hand and secured. If a deep hole is found, where sponges are more liable to have escaped capture than elsewhere, the fisherman dives and examines the bottom. And thus the work goes on, the diving alternating with the wading until the day's work ceases. But, despite the toil, there is little earned in this way, for the sponges obtained are young, undeveloped, usually ill-formed, and lack the firmness of those taken in winter.

Many of the foreign fishermen use a "trident" or sponge spear in water as deep as from 30 to 40 feet. These have three to six prongs. The success of this method of fishery depends upon the clearness of the water and the fact that the sponges rise sufficiently above the other objects on the bottom to be readily seen. A water glass is used when the surface of the water is rippled by a breeze. This is a hollow tin cylinder with a glass at one end and open at the other. It is pushed into the water and the bottom of the sea can be clearly seen with it. The fisherman bends over the boat's side, carefully watching the bottom through the water glass until a sponge is seen, when the spear is thrust quickly down with unerring aim into the object sought. A sort of combined rotary and seesaw jerky motion is given to the spear, and the sponge is torn from its fastenings and promptly brought on board the boat. The Arabs use crudely made tridents with five or six prongs, and as a sponge must necessarily be torn more or less when a spear enters it, these are much more objectionable than "focina," or the three-pronged spear of the Sicilian fishermen.

Another method of fishing is with a drag net called "gangava" by the Greeks, who apparently use it more extensively than others. This is a large meshed net, something like a beam trawl, with a bag or purse 6 to 10 feet long. It is fastened to a frame 19 to 39 feet long, and from about 19 to 31 inches high. The upper beam is wood, and the lower side of the frame is a round iron bar. This device is

towed over the bottom with a stout warp, by the boats called "sacoleves," which carry 4 to 6 men, and have a large sail area to enable them to operate the dredge.

The "gangava" is put out like an oyster scraper or dredge, so that the iron bar will go next to the bottom, and sufficient towing warp is veered out for the depth of water and force of wind. The boat then sails or drifts, dragging the net after her until the deadening of her way indicates that the dredge is filled, when the boat is hove to and the apparatus is raised by a "hand-hauling" device at the bow.

Diving for sponges is pursued to a very limited extent by some of the natives. Attempts have been made to introduce diving apparatus in this fishery, but the expense was too great, both for the appliances and the men to work them.

Squid fishing.—The squid fishery at Tunis is participated in by many natives.

When this cephalopod appears on the surface or is swimming under water they catch it with their hands or with the same harpoon that is used for sponge fishing.

In the deep waters in which they can not fish on foot, principally in the places beaten by the stream, the natives, in order to catch poulps, lay down on the bottom a long rope on which they hang at certain distances small water jugs called "gargoulettes." These jugs, which bulge out, are opened at the two extremities, and thus make suggestive little cells, speedily occupied by the mollusks.

Poulps introduce their tentacles into the jugs and can not easily draw them back. They are taken out of the jugs by means of a sharp tool.[1]

Fishery products.—The exhibits of fishery products included oysters and canned sardines; also tunnies. The secondary products embraced manufactured coral, pearl shells, carved or otherwise, imitation pearls made from fish scales, fish glue, and fish-scale flowers, etc.

The preparation of sardines has been discussed in the preceding chapter on methods of fishery.

The tunny is in favor in France, as in all the Mediterranean countries, but from the American standpoint is not so valuable as many other species of fish. It is true there is a moderate demand for it here when fresh, but attempts to put canned tunny on the American market under the name of "sea salmon" have not been successful. The French product is similar to that packed in New England—a wholesome, nutritious food, but lacking the delicacy of flavor of other canned fishery products which abound in our markets.

The collections of carved and polished shells and imitation pearls were creditable, but the fish-glue and fish-scale work were inferior to American products of that class.

The collections from Tunis included salt, anchovies, and pilchards, pearl shells, a bunch of coral in its natural condition, and sponges.

Method of preparation.—The statements made elsewhere regarding

[1] Tunis at the International Fishing Exhibition of Bergen, page 46.

the preparation of fishery products need not be repeated here. The cod is cured by the French in substantially the same way as prevails in New England and the British North American provinces for making kench-cured fish. The fish are first salted in kench on board the vessels. After the arrival of the vessels the fish are washed and dried on frames.

The squid taken in Tunis are dried for exportation. To prepare them for drying, the hard skin that covers the head is first removed. A squid is then taken by the upper part of the body and vigorously pounded upon the ground for about one hundred and fifty times, for the double purpose of killing it and softening its flesh. Subsequently it is worked back and forth upon the ground, under a strong pressure, for the purpose of causing the ejection of any water it may contain. Then it is hung on a rope to dry in the sun, but no salt is put on it, for this is considered unnecessary, since "the evaporation of the sea water the mollusk still contains after the described operations leaves in the flesh salt enough to preserve it."[1]

Accessories of fish packing.—The most notable object under this head was the exhibit of salt made in the Tunisian section, by the Salt Works Company (Saline de La Soukhra) of Tunis. In addition to the salt itself, the company exhibited a relief model of its salt works and several photographs showing the methods of collecting salt and transporting it to the point of shipment.

It is only recently that the manufacture of salt has been undertaken in the regency of Tunis as a private industry. Indeed, it is stated that the utilization of the resources of the salt lake Sebka El-Rouana was not begun until 1897, notwithstanding it yields more than a million tons of salt annually, which rivals in quality the best salt used in the fisheries, such as that obtained at Cadiz and Trapani. Following is the analysis:

	Per cent.
Sodium chloride	97.696
Magnesium chloride	.407
Magnesium bromide	"
Magnesium sulphate	.105
Calcium sulphate	.232
Silica, iron, etc	.06
Water	1.50

This analysis proves the absence of deleterious or insoluble ingredients and indicates a high percentage of pure salt—chloride of sodium. This seems to be a matter of interest to the fishing industry of the United States, which imports large quantities of salt from Mediterranean ports, for if a desirable salt can be obtained from Tunis a trifle cheaper than from other places Americans may profit by importing it.

I personally examined this salt and found it about as coarse as Cadiz

[1] Tunis at the International Fishing Exhibition of Bergen, page 47.

salt and apparently cleaner than the latter and better adapted to curing fish. It has been introduced in Norway, and is favorably received by the fish packers.

Several parties exhibited salt manufactured in France, but it was of a lower grade than that made in Tunis.

Refrigeration. Ice-making and refrigerating machines, in motion, were exhibited by Civil Engineer Douane, of Paris. In these chloride of methyl was used for the production of low temperature and ice, instead of ammonia or other material. The results seemed eminently satisfactory, as was evidenced by the fact that the exhibitor received the highest award.

The use of chloride of methyl as a volatile liquid in refrigeration

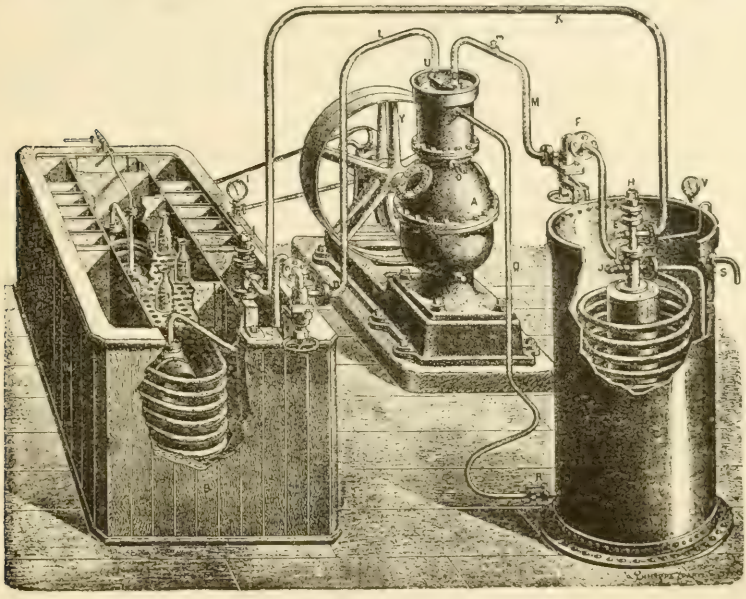


FIG. 286.—Refrigerating machine.

seems to be comparatively recent, and it is claimed that for this purpose it has many advantages over ammonia, sulphuric acid, or other materials that have been tried, more especially in freedom from danger to those whose duty it is to operate the refrigerating or ice-making plant; for, as is well known, disastrous and fatal accidents sometimes occur when ammonia is used, and the bursting of a pipe distributes the powerful gas so suddenly and with such overpowering force that escape is practically impossible for those near by who are not protected from the fumes.

Chloride of methyl is described as a colorless gas. Its density to the air is 1.738, and the weight of a liter is 2 grams, 260 at 0° C. and under pressure of 760 millimeters of mercury. Its particular smell

reminds one of chloroform; and without having the painful and suffocating intensity of amonia or sulphuric acid, it is sufficiently characteristic to help in finding a leak. When compressed, chloride of methyl becomes liquid, and is colorless, very fluid, possessing lubricating power equal to sulphurous acid, and does not corrode metals. Its density at 0° is 0.952. Its latent heat of vaporization is near sulphurous acid; it is near 97 calories. It boils at —23° under atmospheric pressure.

The chief objection made to it is its inflammability. But while this is conceded, it is claimed that its vapors do not explode, and that the danger is so slight that no extra charges are exacted for its use by insurance companies.

The advantages claimed are that it is as effective as ammonia in producing low temperatures; that it is free from the objection of corroding metals, therefore a plant will last longer; that it is a lubricant, and consequently the machines work easily; that it is cheap; and that it is harmless to workmen who watch and repair the machines.

The refrigerating machine exhibited is shown in figure 286.

Olive oil for table use and for fish packing was exhibited by several parties.

Life-saving.—The Société Polytechnique de Sauvetage exhibited illustrations of methods of life-saving. These showed, among other things, the correct method of rescuing from drowning a person who can not swim, and who has sunk beneath the surface of the water; also the proper method to follow in resuscitating a person apparently drowned.

Cork jackets and vests stuffed with soot for life-saving purposes and the common form of circular life buoy were also exhibited, but these appliances were quite ordinary, except the soot-filled garments.

JAPAN.

Commissioner.—Dr. Kamakichi Kishinouye, a well-known zoologist and authority on oriental fish and fisheries, was the commissioner from Japan. He was assisted by M. Matsuzaki and S. Nomura.

General considerations.—While the Japanese collections were not so extensive as those from some other countries, and were crowded into inadequate space, they were nevertheless well arranged and were exceptionally interesting and instructive. It is evident that the attempt to illustrate all phases of the fisheries in a country so remarkable for the variety and extent of those industries would be a task of great magnitude, especially when we consider the distance the collections had to be transported; but the intelligent observer was able to form conclusions from the objects exhibited, and which it was officially declared were intended only "to give the visitor a glimpse into the fishing industries of the Japanese Empire."

From many points of view Japan may safely be considered the foremost fishing country of the world. Indeed, the statements made by competent writers are startling, and are explainable only by the fact that a very large part of the animal food consumed in the Empire comes from the water. It has been asserted by some that fully 87 per cent of such nutriment is produced by the fisheries. The obtainment of such vast quantities of alimentary products for the supply of a nation is in itself enough to employ an army of men. But when we consider that the fisheries yield many products that can not be classed as food, but are useful in the arts and industries, the magnitude of the piscatorial enterprises of this oriental Empire forces itself upon the mind. The importance to the nation of its fisheries will also be apparent. For, instead of large numbers of men being engaged in raising stock for supplying beef, mutton, etc., Japan has a vast fishing flotilla, and great armies of fishermen, who gather the harvest of the sea and exact tribute from all waters within easy reach that can yield anything useful to man.

Dr. Kishinouye is authority for saying that the fleet of small vessels and boats employed in the fisheries of Japan numbers about 400,000, and the fishermen exceed 2,500,000 in number. He very properly concedes that these figures are large, but thinks that when consideration is given to the fact that the empire is composed of many islands, with an aggregate coast line exceeding 30,000 kilometers, it will be found "they are not big at all."

The fishing grounds of Japan are reputed to be very rich and productive, teeming with fauna and flora of many varieties. It is claimed that there are scores of marine products, the annual yield of each of which exceeds $150,000 in value per annum. When we consider the low value of labor in the Far East, and the consequent low price of fishery products, the actual magnitude of these figures will be more evident.

The most important and largest fishing grounds lie west of Japan, between the islands and the continent, and in the Inland Sea. There the water is comparatively shallow, particularly that section west of the islands known as "Tong Hai," which has less than 200 fathoms. As a rule, the water is deep around the Japanese islands, and it is common for line fishing to be prosecuted in depths exceeding 300 fathoms.

On the eastern side of the islands the sea bottom descends very abruptly, so much so that in most places the 100-fathom line is close to the coast, and often a depth of 1,000 fathoms is very near the land. Only surface fishing can be prosecuted on that side at any considerable distance from the shore.

A warm current called "Kuroshiwo" washes almost the entire coast and brings warmth as well as many useful food fish, such as fishes of the mackerel family. In summer the current is strong and approaches nearer to the coast. It has the velocity of 30 to 50 miles in one day. A cold current called "Oyashiwo" washes the northeastern coast, which brings cod, herring, salmon, etc. This current is strong in winter.

In Setouchi-umi (the inland sea) and other bays water is comparatively shallow, and there we find good grounds for the trawl fishery, and also for the culture of many shellfish and algæ. Lakes and rivers also furnish many useful fish and shellfish. The fresh-water fisheries, however, are not so important as the sea fisheries.[1]

Undoubtedly marine fishing is of very ancient origin in Japan. This is indicated by the discovery, from time to time, of shellfish, fishing implements, fish bones, primitive pottery, and stone implements in shell mounds on the coast. Thus it would appear that even at that early age, when stone implements were the only ones used, the food, ornaments, and many other things needed by the people were obtained from the sea.

The complete statistics of the yield of the Japanese fisheries are not available, but the following figures, which do not include the results obtained at Hokkaido, will show the great amount of fish products of certain species taken in 1895:

	Quantity.	Value.		Quantity.	Value.
	Pounds.			*Pounds.*	
Herring	16,415,850	$45,616	Ayu (Plecoglossus)	4,877,375	$150,141
Sardine	452,583,525	2,424,131	Shark	9,564,133	98,481
Bonito	74,113,717	983,009	Salmon	1,726,625	122,897
Tai (Pagrus)	38,954,567	808,827	Trout	604,050	19,206
Mackerel	56,569,783	478,987	Shrimp	34,631,708	298,535
Tunny	32,429,133	467,653	Oyster	6,415,133	49,523
Cod *a*	9,578,892	56,625	Sea ear	6,391,200	132,595
Pelamid	33,348,250	503,186	Sea cucumber	4,558,517	46,019
Flatfish	30,883,567	261,118	Whale	4,475,878	88,332

a The omission of the very important cod fishery of Hokkaido from this enumeration makes the relative catch of cod appear much less than it really is for the Empire.

The foregoing statistical statements, based on official data, show a total catch for 1895 of the principal species of 821,421,653 pounds, or upward of 410,710 tons, with an aggregate valuation of $7,034,881. When consideration is given to the fact that these figures apply to only comparatively few of the many objects of fishery in Japan, and do not include any of the extensive fisheries of Hokkaido, the magnitude of the fishery industries of the Empire will be appreciated, even if the low price of labor makes the values less impressive than they would be if estimated on the basis of prices in the markets of the United States.

An idea of the productiveness of the Hakkaido fisheries may be gained from the fact that it is officially claimed they annually yield 41,489,400 salmon, besides 14,965,200 spring salmon, 6,816,600 codfish, 170,108,700 pounds of herring, and 59,456,430 pounds of sardines. If we estimate that the salmon and cod average only 10 pounds each, the aggregate weight is 632,652,000 pounds.

But it is in the enormous fleet of boats, in the great number of fishermen, in the intelligent utilization of practically everything the sea yields, that Japan excels, and the student of political economy can not

[1] The Fishing Industry in Japan, by Dr. K. Kishinouye, p. 4.

fail to appreciate the significance of all this to a nation that has given such evidence of enterprise and progressiveness, and which aims at commercial prominence and naval power. For here is an industry which supports a vast body of fishermen and which, in addition, must necessarily train thousands of seamen annually who are available to man merchant ships or war vessels. Thus, aside from the purely economic aspect of the fisheries when considered by themselves, they seem to have a most important bearing upon the future greatness of the Empire.

The material exhibited by Japan was largely from the Government collections.

Fishing vessels and fishing boats.—The largest of the Japanese fishing craft are comparatively small in dimensions, and though, strictly speaking, they should be classed as vessels, their adjustable decks and other features impel one to consider them as boats, with few exceptions.

A large majority of the flotilla employed in the fisheries is composed of boats of moderate dimensions, which may be propelled either by oars or sails, but generally by both.

Certain general features characterize the fishing boats of Japan, whether large or small, and some of these are distinctively oriental. All the boats have flat bottoms. These are generally narrow; the garboard is wide and strongly flaring, and the upper streak is also wide and nearly vertical. In cross section a Japanese fishing boat resembles the skipjack type of boat used to a limited extent in the United States. The bow is long and sharp, usually with straight or slightly convex lines, and the stem raking at a sharp angle. The stern is square and vertical, with a stout timber at the top, cut in the center to receive the rudder post; and it is remarkable for the extension of the planks some distance farther aft, thus forming an open space or well abaft the stern crosspiece. These planks, however, are open at the bottom for a small space, to allow the rudder to be moved at a moderate angle. The rudder is long and adjustable, and when in position it extends a considerable distance below the stern. There is no skag, keel, centerboard, or leeboard; consequently the boats can not sail to windward, and must be propelled with oars if the wind is adverse. This applies to the larger fishing craft as well as to those of smaller size.

The method of rowing is peculiar to Japan, and differs radically from that in vogue in Europe and America. As a rule a boat has one or more stout timbers crossing its top and usually projecting from each side a greater or less distance, this generally depending on the size of the boat. In each end of these beams is a wooden peg or thole that fits into a cavity in the oar loom, so that, while it holds the oar from slipping about, the latter can be easily worked and twisted to get the desired motion. This is a sculling motion, the oar not being raised from the water, but twisted in such a way as to have the same effect

as a propeller. The men stand erect to row, and on the larger boats two men are required to operate each oar. The bodies of the oarsmen sway back and forth in regular cadence, generally timed by the chanting of a song. The Japanese are celebrated for their skill and power in propelling their boats in this manner.

The typical rig is one or more square sails, with the various breadths loosely laced together, in such a way that the wind will pass through between the edges of the canvas. Recently, however, some changes in rig have been introduced, of which more extended mention will be made in succeeding pages.

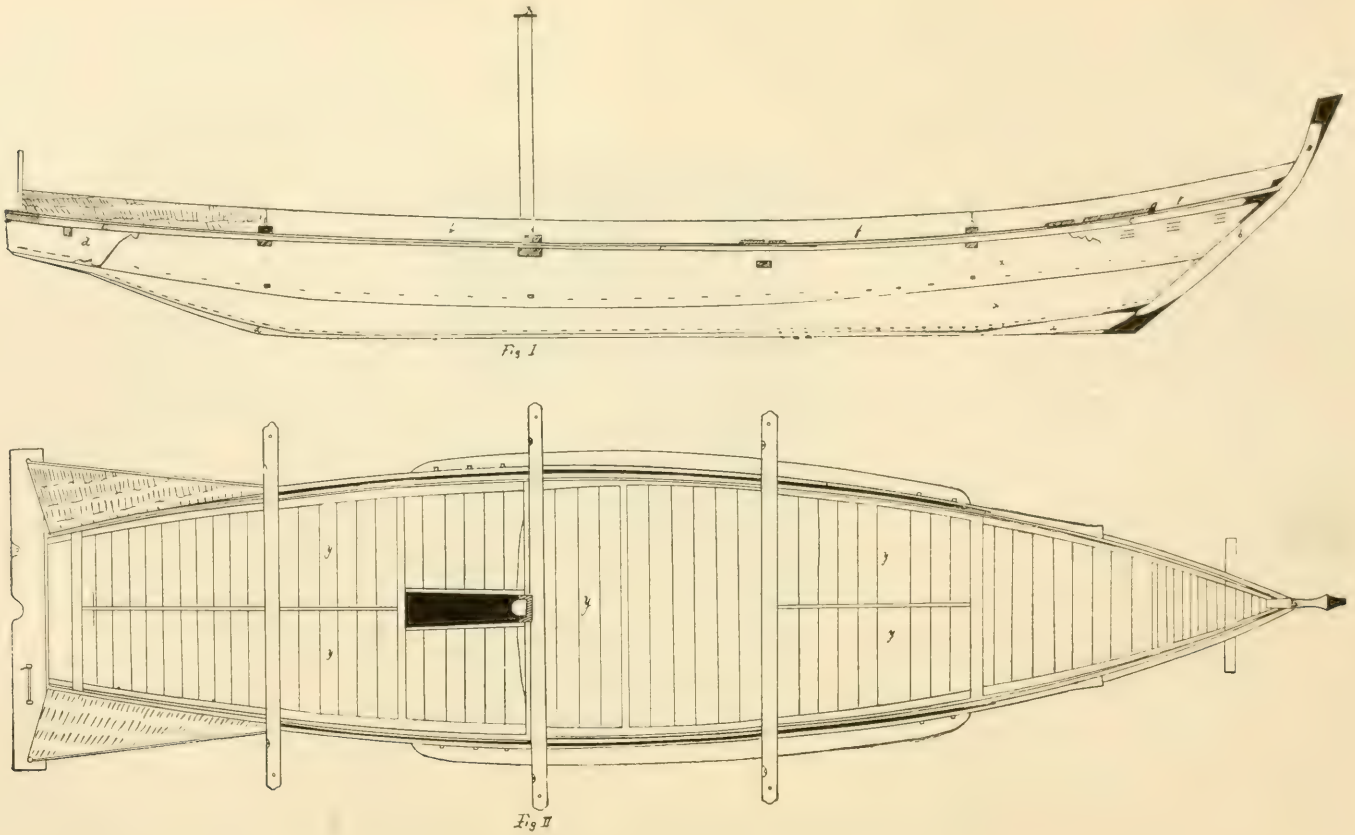
On certain parts of the coast of Japan from which fishing is extensively prosecuted there are no harbors, and consequently it is necessary to land in the surf, which is often high, and pull the boats upon the shore, from which they must be launched for the next trip. It is, therefore, important that they should have a light draft and a flat bottom made of thick, stout planks. The fishing boats are all built in this manner, however, whatever the conditions of environment, unless it be dugout canoes or some form copied from European or American types.

Fishing schooner.—Recently the fisherman of Yokkaichi, near the center of the empire, have adopted the schooner rig on some of their boats engaged in trawling with nets. I am informed the first of these was built in 1893.

These schooners go 10 to 20 miles from the coast and catch flat fish, gunards, and other bottom-feeding species, with purse-shaped trawls similar in form to the otter trawl, but having no otter boards. The wings of the net are spread by lines leading, respectively, to the long bowsprit (which projects much farther than required for the jib) and a pole or outrigger from the stern.

The schooner rig is found suitable to this fishery, for when operating a trawl the boat is hove to, so as to drive sidewise to leeward, dragging the trawl over the bottom, and the fore and aft sails can be trimmed to secure the maximum of towing power in this direction.

A model of one of these schooners was exhibited at Bergen (fig. 287). This has many of the characteristic Japanese features of form and construction, including the narrow flat bottom, "skipjack" cross section, and an excessively long, sharp bow, which was fully three-fifths the boat's length. It has also the crossbeams projecting from each side. It differs, however, from the typical Japanese fishing boat in having an overhanging round stern and skags forward and aft. It has a long square-footed rudder, which extends below the skag, and the stern is open so that the rudder can be hoisted, as is customary on these boats. The rudder is operated with a long, straight tiller. The schooner is decked and has raised quarter rails.



PLANS OF KAWASAKI.

Fig. I, Sheer plan; Fig. II, deck plan. Drawn by J. W. Collins.

The rig consists of two pole masts and a long bowsprit. The foremast is jointed at the deck and can be lowered. Two boom and gaff sails, fore staysail, and jib are carried. The foresail and mainsail have low peaks and are not cut in accordance with Western ideas. Two long oars or sweeps are carried.

Following are the dimensions of a vessel of this class: Length over all, 73 feet 10 inches; beam, 14 feet 7 inches; depth of hold, 3 feet 9 inches; foremast, deck to truck, 40 feet 10 inches; stem head to foremast, 22 feet 6 inches; between masts, 22 feet 6 inches; mainmast, deck to truck, 30 feet 9 inches;[1] bowsprit, outboard, 13 feet 6 inches; foreboom, 20 feet 10 inches; foregaff, 15 feet 10 inches; main boom, 20 feet 10 inches; main gaff, 16 feet 8 inches; oars, 20 feet long.

The kawasaki.—A large fleet of boats, the typical name of which is "kawasaki," is employed in the codfishery from the island of Yesso,

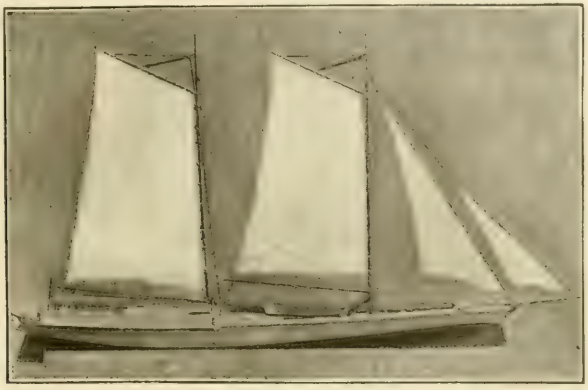


FIG. 287.—Fishing schooner.

or Hokkaido, in northern Japan (Pl. LIX). They are open, flat bottomed boats, heavily and clumsily built, but nevertheless said to be quite seaworthy.

There are no harbors on the coast of Yesso from which these boats sail, and therefore they are compelled to land upon the open shore, where frequently the surf runs high. For this reason flat-bottom boats have been adopted, and it is said that in beaching their vessels the Japanese fishermen run them on the shore stern first.

With the exception of its stern the kawasaki closely resembles the Connecticut sharpy. It has the long, sharp bow, wide, flat floor, and slightly flaring sides of the sharpy, but differs from the latter in having no skag and in the stern being built somewhat similar to that of the Chinese junk, so that the rudder may hang to a broad beam, which crosses from side to side.

[1] There is a raised section of deck at mainmast, about 2 feet high.

This type of boat has a single tall mast, on which is set a large, rectangular, loose-footed, square sail. The mast is set up in a manner so that it can be lowered when it becomes necessary to use sculls or to replace it with a shorter mast, which is always kept for use in a heavy storm. When sailing is difficult the boat is propelled by six sculls.

When the wind is favorable the kawasaki generally sails to and from the fishing grounds or wherever it may be necessary for her to go, but she can not sail to windward, and consequently has to be propelled by oars when the wind is ahead.

The dimensions of a full-sized cod boat are: Length over all, 40 feet 10 inches; beam, 10 feet; depth, 3 feet 9 inches.

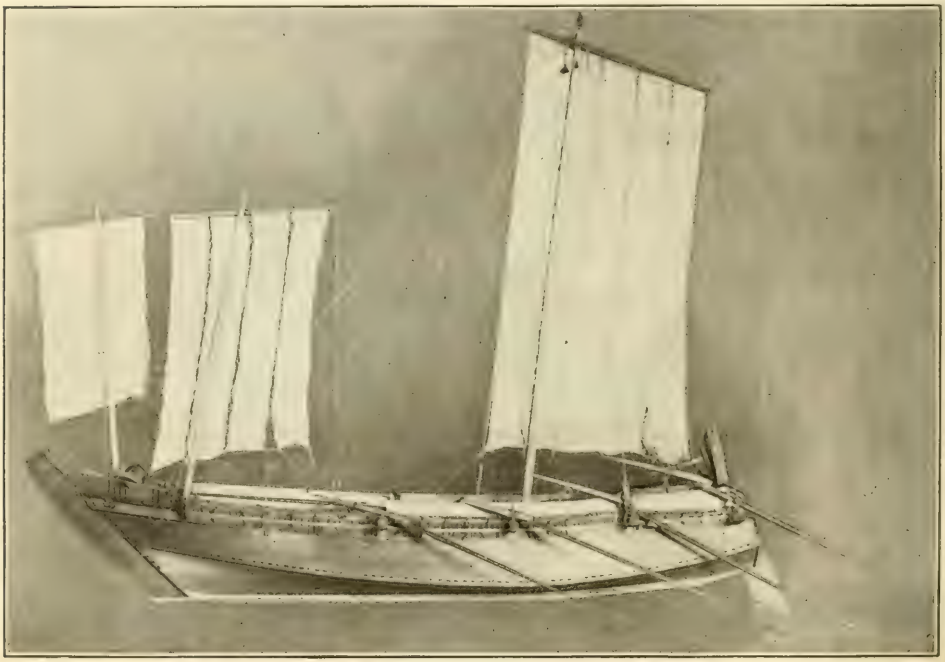


FIG. 288.—Tunny fishing boat.

Bonito fishing boat.—The boat used in the bonito fishery is essentially the same in type, so far as form is concerned, as the American skipjack, though having a general resemblance to the kawasaki, from which it differs in rig. It has three square sails, there being a short mast and comparatively small sail near the stern and another small sail near the bow. The mainmast stands well aft, less than one-third the boat's length from the stern. Dimensions of full-sized boat: Length over all, 42 feet 6 inches; beam, 11 feet 5½ inches; depth, 3 feet 9 inches.

Tunny fishing boat.—This type of boat (fig. 288) is a seagoing craft, for in the pursuit of the trawl-line fishery for the several varieties of tunnies it often goes from 50 to 100 miles to sea on the Pacific side of

Japan, and consequently is exposed to heavy seas and whatever conditions of weather may chance to occur in the open ocean.

Four species of fish are taken—the common tunny or horse mackerel (*Thynnus thynnus*), the albicore (*T. albacora*), the long-finned tunny (*T. macropteris* and *T. sibi*).

The tunny boat is typically Japanese in form, construction, and rig, although it is deeper in proportion than most of the boats used near the coast and has a more seaworthy appearance.

It has a long, sharp bow, straight raking stem, very narrow flat bottom, and the clinker build peculiar to the fishing boats of the country—the garboards rising at a more or less sharp angle, according to their positions, and the wide upper streaks being nearly vertical, except at the bow, where they flare slightly. The after part of the bottom and garboards curve upward, but there is no run, properly speaking. It has the conventional Japanese square stern, with projecting open space, and a heavy cross beam for the long rudder to ship into. This beam projects beyond each side about 2 feet, and four other beams—one of them well forward—likewise extend beyond the sides from 2 to 2½ feet. Along each side, from the forward beam to the stern, is a chafing mat about 20 inches wide, made of reeds or grass, and held securely in place by strips of wood or bamboo nailed over it.

There is a quarter rail or bulwark from 12 to 15 inches higher than the main rail, extending from the stern to amidships on each side. On either side of the bow is a short piece of bulwark of about the same height.

The boat is decked forward of amidships, and has five hatches leading to the crew's quarters, the gear rooms, etc. Abaft this the deck is composed of small adjustable sections. On one side of the deck, abaft the mainmast, is a square water tank, and on the opposite side is a large box for provisions, etc.

This type of boat has three masts, and three square sails the breadths of which are laced together in the usual manner. The forward mast stands close to the stem and rakes forward; the next mast is stepped only a few feet distant, but rakes aft, so that the heads of the spars are nearly twice as far apart as their heels. The mainmast is a little more than one-quarter the boat's length from the stern; it is much longer than the others; the area of the mainsail exceeds considerably the combined area of the other sails. With the exception of a single stay from the mainmast head to the weather side of the forward crossbeam, the masts have no support other than that obtained from the halyards, which are belayed as far to windward as possible.

The sails can be used only with fair or leading winds. With unfavorable winds the sails are lowered, the masts are unshipped, and oars are the motive power. There are three oars on each side.

The principal dimensions of one of these boats are as follows:

Length over all, 43 feet 4 inches; beam, 9 feet 7 inches; depth, below deck, 3 feet 2 inches; foremast, above deck, 17 feet 6 inches; foreyard, 9 inches; width of foresail, 8 feet 4 inches; middle mast, above deck, 19 feet 7 inches; yard, 11 feet 3 inches; width of sail, 10 feet; mainmast, above deck, 31 feet 8 inches; main yard, 17 feet 6 inches; width of sail, 16 feet 8 inches; rudder, 12 feet 6 inches long, 22 inches wide; oars, 20 feet 10 inches long.

Cockle-dredging boat.—A long and comparatively narrow boat is used on some sections of the Japanese coast for dredging cockles, in which fishery seven dredges are operated at the same time (fig. 289). The boat is hove to, so that it will drive sidewise to leeward, dragging

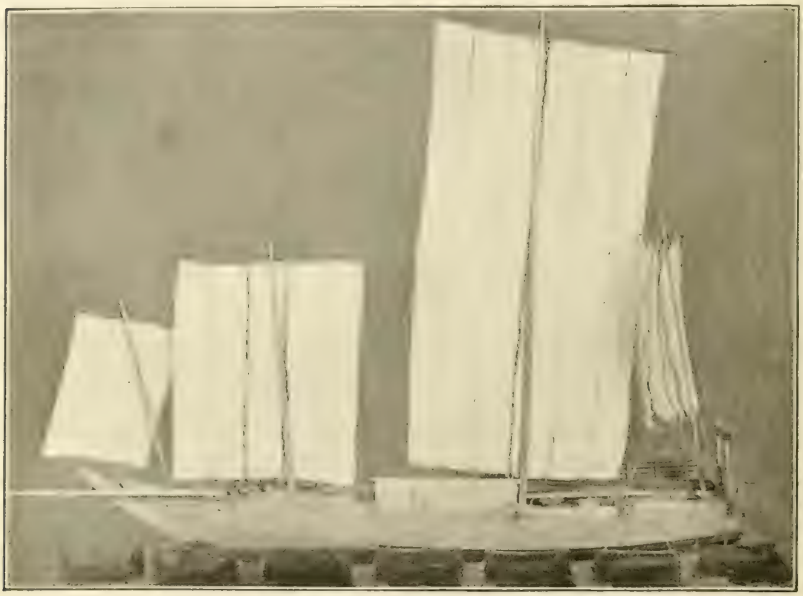


FIG. 289.—Cockle-dredging boat.

over the bottom the dredges, which are attached to the windward side by towropes of suitable length.

The boat is of the ordinary Japanese type. It has a long, sharp bow; strongly raking stem; narrow, flat bottom, rising somewhat in after section; square, open stern; long rudder; and framework above stern for lifting the rudder, etc. It is decked, and has a projecting double bowsprit or outrigger, to which the fore square sail tacks.

It has four masts, on which only square sails are set. The foremast stands close to the stem and has a strong forward rake. The next mast abaft this also rakes forward. The mainmast, which is about one-third the boat's length from the stern, is much longer than any other and has a slight rake aft. The jigger mast is nearly vertical and is at the extreme stern.

The principal dimensions of one of these boats are as follows: Length over all, 31 feet 8 inches; beam, 6 feet 7 inches; depth, 20 inches; rudder, 9 feet 11 inches long, 15 inches wide; foremast, above deck, 10 feet 5 inches; foreyard, 6 feet 3 inches; second mast, above deck, 13 feet 11 inches; yard, 9 feet 11 inches; mainmast, 23 feet 9 inches; yard, 13 feet 3 inches; jigger mast, 14 feet 2 inches; yard, 7 feet 6 inches; bowsprit, outboard, 3 feet 9 inches; oars, 20, 19, and 18 feet long.

Scare-cord fishing boats.—A fleet of at least nine boats is required to operate one of the great scare-cord nets and to market the catch. These are two seine boats, the captain's or seine-master's boat, two

FIG. 290.—Market boat.

boats which operate the scare cord, two anchor boats, a merchant's boat, in which the dealer seeking to purchase the catch remains in the vicinity of the net, and the market boat that transports the dead fish to the nearest market town. The living fish are taken in the merchant's boat, which is provided with a well.

The market boat.—This has the typical long bow and narrow, flat bottom. The latter is straight for two-thirds of its length from the stem, but rises sharply in its after section. The open stern and clinker build are of the ordinary Japanese style. Above the stern is a frame for resting the mast on when it is unshipped (fig. 290).

Four heavy beams, and two lighter ones at the bow, cross the boat from side to side, resting on the gunwales, beyond which they extend.

Along each side is a thick clamp, and pieces of plank, made for the purpose, rest on this and on a beam that runs longitudinally along the center of the boat, and these when laid down make an adjustable deck, each part of which can be removed or put in place as occasion demands. The quarter deck, extending from the stern to just forward of the mast, is somewhat higher than the forward deck.

A square sail is set on the single mast when running free; at other times the mast is usually unshipped and rests on the frame at the stern. This frame is provided with a roller, so that the mast can be easily moved fore and aft, which facilitates raising it into an upright

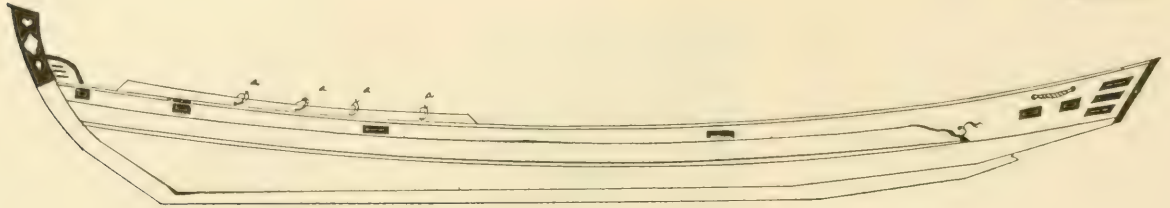
FIG. 291.—Captain's boat.

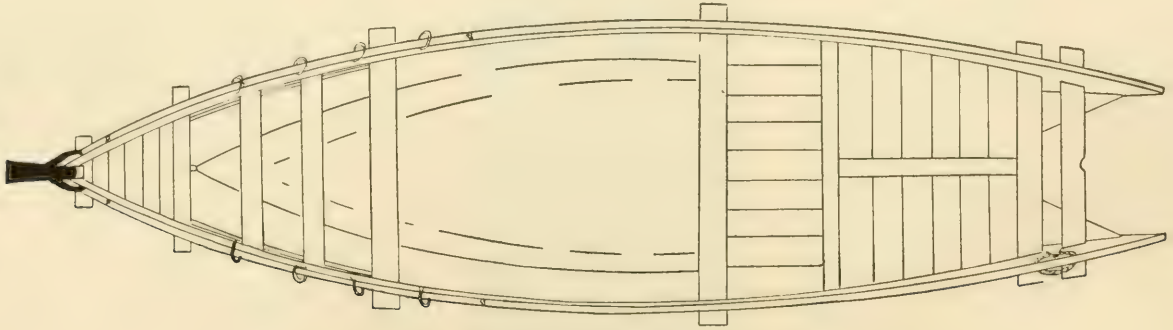
position. Four oars are used. The ordinary four-pronged iron anchor is carried.

The dimensions of a boat of this type are as follows: Length over all, 21 feet 8 inches; beam, 5 feet 7½ inches; depth, 20 inches; mast, above gunwale, 14 feet 7 inches; yard, 10 feet; oars, 9 feet 3 inches.

Captain's boat.—This boat (fig. 291) has the same dimensions, form, and construction as that last described, differing only in details for accommodation of the crew. It has a cabin forward.

Other boats.—The merchant's boat differs from all the market boats chiefly in having a well for keeping fish alive. The dimensions of all the boats, as well as the construction and rig, are substantially the same. Thus, the two boats employed for working the scare cord to frighten the fish into the net and the two used for laying out anchors to hold





PLANS OF SAMPA.

a, *a*, *a*, *a*. Rowlock straps. Drawn by J. W. Collins.

S. Doc. 39——28

the net in place are duplicates of the one described. The boats which set out the net, however, differ in having two frames at the stern, and in the cross beams projecting on only one side (fig. 292).

Purse-seine boats.—Two boats are used in operating a purse seine. These are of the Japanese type known as "sampa" (Pl. LX). Each boat has three crossbeams, the forward one being a trifle forward of amidships, and the others placed so as to about equally divide the space between that and the stern. These project on one side only, so that the opposite sides of the boats can be brought together when the seine is being pursed up. Across the bow of each boat and projecting a short distance beyond each gunwale, is a small hardwood beam, which is securely fastened in position. On one end of this is a brass roller—a sort of elongated sheeve or pulley much longer than the diameter—over which the purse line is hauled, this being supposed to be kept in position by a slight enlargement of the pulley on each end. When pursing up the net the boats lie beside each other, with bows

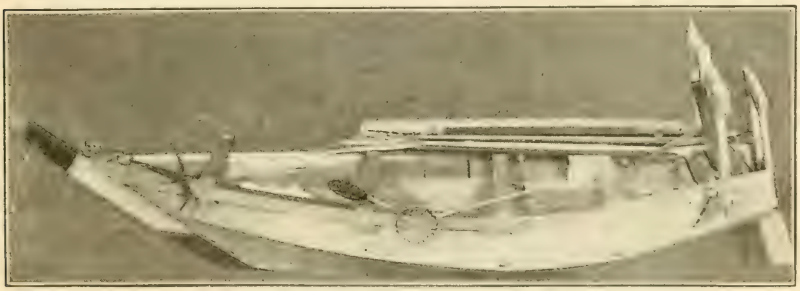


FIG. 292.—Seine-cord net boat.

abreast, and the crew of each pulls on one part of the purse line until the bottom of the seine is closed and the purse rings are at the surface of the water. The purse line, after passing over the roller, reeves through a single block hooked to the middle of the after crossbeam, then through a single block hooked to the center of the roller beam and thence runs aft. This gives a good purchase and affords opportunity for all the fishermen to pull to advantage. But the horizontal roller, above referred to, though well made, is a crude device for the purpose, for it is evident that the purse line is liable to slip off and cause much trouble and delay unless the water is absolutely smooth. It is, however, so easy to correct this defect that it may doubtless be taken for granted that the requisite improvement will soon be made. The full-size roller exhibited was 5½ inches long and 3 inches in diameter. This was attached to the end of a galvanized-iron bar, square in cross section, 16 inches long and 1¼ inches diameter. This goes into the end of the wooden crossbar and is held in place by two flat keys, which go through wood and iron.

The dimensions of each of the seine boats are as follows: Length over all, 18 feet 4 inches; beam, 4 feet 5 inches; depth, 20 inches.

Salmon fishing boat.—A model was exhibited of a small, flat-bottom skiff that is used for catching salmon with bag nets (fig. 293). It has a sharp bow, raking stem, strong camber to bottom, and square stern which projects at the top. It is decked forward. Over the central section is an adjustable house that can be quickly taken down. When the nets are set near the boat, they are connected by a cord with an apparatus inside the house holding three bells. Thus the fisherman is promptly informed if a salmon is caught, for the rush of the fish against the net puts a strain on the cord and the bells jingle.

The dimensions of one of these boats are as follows: Length over all, 16 feet 8 inches; width, 4 feet 5 inches; depth, 20 inches; house width of boat, 5 feet long, 2 feet 6 inches high at sides, and 4 feet 7 inches high from bottom of boat to ridge pole; oars, 9 feet 2 inches long.

Apparatus of capture.—No people in the world appear to have been

FIG. 293.—Salmon boat.

more fertile than the Japanese in devising appliances for the capture of the various objects of fishery. Thus, though the exhibit of Japan was crowded into narrow limits, it embraced many interesting objects of this character, and one familiar with the remarkable diversity of Japanese fishing gear could appreciate the fact that all kinds were not represented.

Nets and seines.—The Japanese use a great variety of nets, including gill nets, several sorts of seines, pound nets, circle nets, etc. Some of these are most effective appliances for the capture of fish, and are probably not excelled in this regard by any similar apparatus.

Dolphin nets.—Nets are used at Tago, in the province of Izu, for catching porpoises or dolphins, of which the most common species is the *Delphinus longirostris*.

These consist of three separate nettings, called, respectively, the "closer," the "seine," and the "tuck seine." The first is used for closing the mouth of the bay when the dolphins have entered it. It is made of grass ropes, and the meshes are about 2 feet and 5 inches.

The seine is used for encircling the dolphins and drawing them nearer the land. Its central portion is made of hemp, and the meshes are here about 8½ inches; while the two lateral portions are made of grass ropes with meshes of from about 2 feet to 2 feet and 5 inches. The tuck seine is used for finally landing the dolphins. It is made entirely of grass cord, and the meshes are about 8½ inches. Six boats are attached to it as floats.

Tai seine.—A model of a seine used for catching "scup" or "tai" was exhibited. This net is called a scare-cord seine in English, but is known as "katsura-ami" by the native fishermen, from the idea that its scare-cord resembles in appearance the stem of the ivy. The meshes are largest near the ends of the two wings, where they measure about 5 feet, and, gradually diminishing in size, become at last about half an inch in the central portion. The portion with smaller meshes is made of hemp, while those sections which have large meshes are made of grass cord. The net is divided along its middle line into two parts, which are joined together when used.

The scare-cord is hemp, about 3,750 feet long. To it are attached, at intervals of 2 feet, thin, rectangular pieces of wood. Also, to keep the cord in a horizontal position at a proper depth, stones and barrel buoys are attached to it.

To work the net, each end of the scare-cord is kept on a boat. The two boats, keeping at a convenient distance from each other, row in conjunction, and, gathering together the scattered fish, scare them onto the net, which is kept spread by two other boats which also gather it in after the fish have entered.

This scare-cord net is very large, and several boats are required to operate it. The main section is a great scoop-shaped seine, 1,200 feet long and 800 feet deep, according to the model exhibited; the bunt, where the fish are gathered in a mass before they are removed from the net, is 135 feet long, horizontally, and 265 feet deep. The wings are each 2,600 feet long and 800 feet deep. Thus the total length of the net is 1,066 fathoms, or considerably more than a mile.[1]

Ayu scare-cord net.—The so-called scare-cord net for catching ayu in the rivers is made of hemp, and its meshes are about 1 inch. The scare-cord is also made of hemp, and is from 200 to 250 feet in length. It bears at intervals short branch lines, also of hemp, to the extremities of which are attached feathers of the cormorant. A single man keeps the receiving net open against the current while four men scare the fish down the stream with the cord and drive them into the net.

[1] These dimensions seem extraordinary and might easily be doubted, except for the fact that they are based on official information, and also because this is in a way corroborated by the fact that so many boats are required to operate the net.

Purse seine.—The purse seine has recently been introduced in the fisheries of Japan, chiefly for the capture of herring or sardines. It is rigged differently from the American purse seine, the rings through which the purse line passes being fastened to the edge of the net instead of to a bridle rope, while the line with sinkers attached hangs below the purse line (fig. 294). This arrangement would seem decidedly unsatisfactory from the American standpoint, and it is morally certain that such a device could not be successfully worked in our waters. Elongated ovate wooden floats are used (fig. 295).

A model of one of these seines was exhibited. According to this a

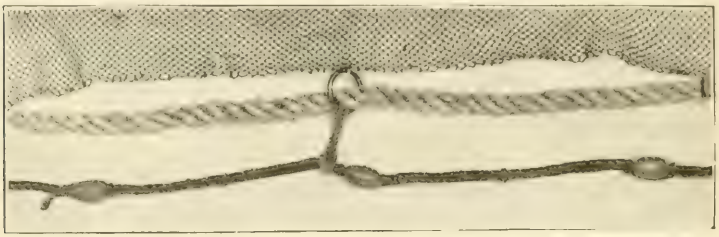


FIG. 294.—Section of purse seine showing purse line and sinkers.

full-sized net of this kind is 617 feet long and 100 feet deep throughout its entire length, for the Japanese have apparently not yet learned the advantage of hanging a purse seine so that its ends will be baggy and not so deep as the rest of the net. Doubtless they will improve it, but the mere fact that they have adopted a device so effective for the capture of fish is in itself a very interesting fact and emphasizes the progressiveness that characterizes them, and which in recent years has done so much to advance the industrial condition of the fishermen.

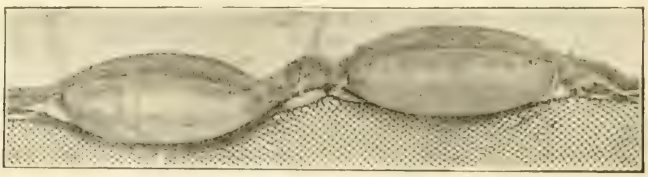


FIG. 295.—Purse seine floats.

Bonito circle net.—A net very closely resembling the American purse seine in the manner of its application is used for catching bonito, and is called a "circle net." It differs from a purse seine in being provided with an apron at its bunt, which is gradually pulled under the fish, after which the bottom of the net is lifted to the surface. This style of net is used at the entrance of the Bay of Tokyo from the latter part of autumn to the early part of winter. The bunt is made of hemp, but the wings are made of grass cord. The net is made up of two halves, each measuring about 1,550 feet in length. The meshes are from about 2½ inches to 5 feet. To work this net 4 boats with 48 men are

required. Of these, two smaller boats serve as leaders, searching out the shoal of fish and giving orders. When the signal is given, the other boats, which have hitherto carried the two halves of the net separately, join them together and encircle the shoal. The wings are gradually tucked in and the fish are driven into the bunt.

Cod gill net.—Nets of this kind are made of hemp, and are used along the shores of the Sea of Japan for catching cod (*Gadus chalcogrammus*). For this purpose they are sunk to the bottom of the sea. A single piece is about 1,212 feet long and about 5 feet high, and the meshes are about 3 inches. For floats pieces of the varnish tree or of *Paulownia imperialis* are used, and for grapnels stone and wood. A single boat uses several pieces joined together. For *Gadus brandti* nets with larger meshes and made of bigger cords are used.

Mackerel net.—On some sections of the southern coast of Japan a peculiar kind of net is used for catching mackerel by torchlight. The following description of this net has been published by the Japanese Government:

> The whole is a rectangular net 60 feet by 210 feet, the central portion being made to hang down slack and form a sort of bag. Its meshes vary in different parts from half an inch to about 6 inches. Four ropes made of straw are tied to the short sides of the net and five to the long sides. At the junction of the net and the rope a stone (of 8 to 10 pounds) is attached.
>
> The net is first of all kept spread flat by four boats holding the ropes tied to the sides. Two boats with dragons then row on to the middle of the net. A large number of mackerel, attracted by the lights, follow them. Then the men in the four boats begin to work in the ropes, and the boats with dragons extinguish them and row out of the net.
>
> This mode of attracting large numbers of the mackerel with torchlights has been in use in Japan for four hundred years.[1]

Tunny drift net.—Drift gill nets are used for catching tunny in the vicinity of the Bay of Tokyo. A single full-sized net of this kind is about 275 feet long and 20 feet wide. Twelve such pieces (or "mogai," as the fishermen call them) are joined into a single net. The meshes are about 7 inches, and the knots are made so as to prevent sliding in either direction. A big rope is tied to the upper margin. In order to make the net float on the surface the rope is made from the fibers of the palm, and floats are fastened to it at the distance of about every 16 inches. The rope of the lower margin is made of hemp and no stones are attached to it.

This net is worked in the spring in the open sea at a depth of 500 to 1,000 feet. Many boats form a line and intercept the route of the fish, and the net is shot down the tidal current. While being drifted one end of the net is kept tied to the boat while the other end is attached to a float, with a floating signal and a lighted lamp.

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[1] Catalogue of exhibits relating to the fisheries of Japan at the World's Columbian Exposition, p. 9.

Sardine bag net.—This form of net is called "boke-ami" by the Japanese, and has been translated as "dip net" in English, though the latter name does not adequately express its character and purpose. It is employed quite extensively on the Pacific shores of the main island for catching sardines, to be used chiefly as bait for bonito. Therefore, it is small, and the fish taken in it are kept alive in the well of the fishing boat. It is hung so as to form a sort of bag, and is nearly square, usually about 35 feet long on each side, and the meshes vary from 1½ to 1⅝ inches. In using this net one edge is spread on bamboo poles rigged out from the side of a boat, and the opposite side, which is weighted with sinkers of lead or stone (lead sinkers were on the model exhibited) hangs loose in the water, but has several ropes leading to the boat by which it can be quickly raised.

To operate this net the boat is first placed with her starboard side against the current, and the net is dropped down from the port side. The bamboo rod, to which one side of the net is fastened, is held in a horizontal position a few feet from the boat by means of the two projecting poles. Some shrimp (*Mysis*) are now thrown into the water from the starboard side to tole the sardines together. When they appear more shrimp are thrown out from the port side to bring the fish over the net, and when the school is in the right position the fishermen pull quickly on the lines, and the sunken edge of the net is promptly raised to the surface, thus inclosing all the sardines that may be over it.

FIG. 296.—Net making machine.

Net making.—Nets are made chiefly by hand. The large net-weaving machines common in the United States and Europe have not yet been introduced in Japan, so I am informed. A small machine (fig. 296) is, however, used for making nets. This is operated by a woman, something in the same way as a sewing machine, and is said to give satisfactory results, though of course in no manner comparable to the large steam-driven machines used by our manufacturers.

Traps, weirs, etc.—The Japanese fishermen have shown much ingenuity and often marked originality in the construction of fish traps, such as pound nets, weirs, etc.

Tunny pound nets.—There are two kinds of pound nets employed for the capture of the tunny or horse mackerel. These are known as the "single" and "double" pound net. The former closely resembles

the ordinary American pound net, but the so-called double net is very much like the device used in the tunny fishery of the Mediterranean.

The first has a single bowl or pound. It "is a fixed net made of straw on a large scale and with great art. It is used at the extremities of wooded promontories in the vicinity of Nagasaki. It consists of two principal parts, the leader and the bowl. The leader, which is set near the coast, has 1-foot meshes. In the bowl the meshes at first are also about 1 foot, but become smaller as they approach that portion which is made of ropes of straw. The net is fixed by stones, some of which are attached to the lower margin of the barrier, and others are put into nets and suspended by ropes of straw from the floats consisting of bundles of bamboo tied to the upper margin of the net. The leader is about 1,150 feet long and 20 feet high, while the bowl is about 350 feet long and 280 feet wide. Two watchmen are always placed on a watchtower to keep a lookout. When the fish enter the bowl along the barrier, a net which is placed at the entrance of the bowl is in the first place drawn up, and the fish are caught in the inner pound by gradually raising up the net of the pound. When, however, they do not enter the bowl directly, the entrance into the pound is closed with another net and the fish are driven into the bowl."

The double pound used in the tunny fishery is also a fixed net and is used in the seas near Sendai in the northern part of Japan. It consists of a leader and a pouch. The former is about 1,750 feet long, and its meshes are about 5 feet; the latter is about 1,740 feet in circumference, and its two blind ends form the inner pound. There are five intercepting nets, viz, one at the entrance of the pouch, another on each side of this, and others at the entrance of each inner pound. These nets are usually allowed to hang down; but when the fish enter the pouch, they are successively raised and lowered, so that the fish are gradually driven into the inner pound. The whole net is provided with stones and with floats of unhewn timber. The meshes of the pouch vary from about 1 foot 4 inches to about half an inch in length.

This net proves itself to have been constructed with a full knowledge of the habits of the fish for which it is intended. Owing to the presence of a rectangular bend in the barrier and the curvature of the pouch, the fish which have once entered the net can not possibly get out of it again. Moreover if a second shoal of fish comes after the first has entered the pouch, the latter is driven beyond the second intercepting net, and the net at the entrance of the pouch is opened; then the second shoal merely swims to and fro between the barrier and the entrance of the pouch for any length of time, and there is no fear of their escape.

In the watch-tower two men always keep a lookout, while below is a boat with six men. When the fish enter the net, word is given from the tower to the boat, and the intercepting nets are put into action.

Moreover signals are made to the fishermen's huts on the shore, according to the number of fish.

Salmon pound net or weir.—One form of salmon "weir" used by the Japanese, according to a model exhibited, is constructed of twine netting attached to poles driven into the bottom, and it is substantially a pound net. It has a leader extending outward from the shore, the ordinary pound-net entrance to the outer inclosure, but the pound or bowl is at one side instead of being directly in front of the head of the leader. The plan is similar to that of the river weir of Maine. The poles are supported by guy lines extending to anchors.

The pound net used for the capture of salmon along the coast of the province of Tokachi in Hokkaido is, in part at least, supported by barrel buoys.

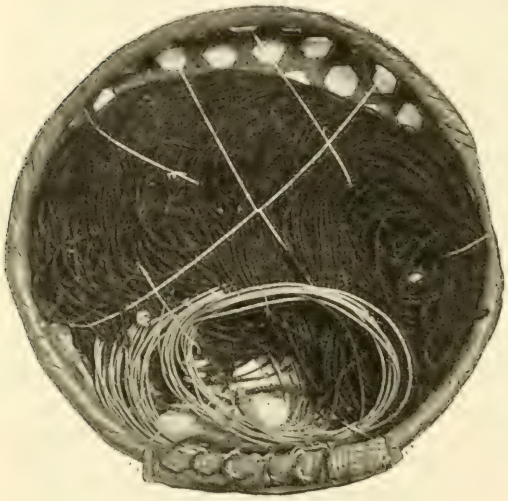


FIG. 297.—Tunny long line.

It consists of a large bowl made of hemp and a leader made of grass rope. The latter is 750 to 1,500 feet long, and its meshes are 2½ to 7 inches. Intercepted by the leader, the fish follow it and enter the bowl. At this time a netting which has hitherto been kept lowered is raised, and the mouth of the bowl is closed. The fish are landed by gradually tucking in the bowl.

Lake weir.—One of the most effective forms of weirs found anywhere in the world is used in Lake Biwa, in the province of Omi. This is made of bamboo splints, and bamboo poles are used for posts. Its plan in general is somewhat similar to the plan of the pound net. The weir consists of three inclosures, however, each of which has no intimate relations with the others, but is complete in itself.

Of these three, that nearest the bank is small and low, being about 10 feet high, and the intervals between the splints being a little over one-fourth of an inch wide. The next one is a little larger, being about 12 feet high with the intervals between the splints about three-fourths of an inch. The last inclosure is largest, and is about 15 feet high with the intervals between the splints about 1¾ inches. It is intended mainly for carps and crucian carps.[1]

Trawl lines.—The trawl line is extensively used by the Japanese for many varieties of fish. Various kinds of these were exhibited.

[1] Catalogue of exhibits relating to the Fisheries of Japan at the World's Columbian Exposition, p. 21.

They are usually in short sections, coiled in shallow, circular baskets that are easy to handle.

Tai trawl lines.—The long lines, or trawl lines, used in fishing for "tai" are provided with snoods about 20 feet long, placed at regular distances apart, so that a section of line 1,900 feet in length will have 95 snoods. In fishing, these sections are fastened, one to the other, and a boat carrying 6 or 7 men will often use a dozen sections.

A stone and a barrel buoy are attached to each section of the line as it is set down, except the first, to which is attached, instead of the stone, a wooden grapnel to fasten it to the bottom. When the whole line has been let down, a stone and a buoy are tied to its end; the boat is then rowed back and the line is taken up from its beginning. For bait, spoon worms (*Echiurus*), sardines, and squids are used.[1]

Tunny long line.—The tunny trawl line exhibited was coiled in a circular shallow basket made of strips of bamboo, the basket being 26 inches in diameter and 5 inches deep (fig. 297).

FIG. 298.—Cod trawl line.

The ground line is cable laid, hard twisted and tanned. Snoods or gangings are made of three-stranded soft-laid line. These are first covered with raw hemp fiber, and then served with fine wire, this protection being necessary to prevent the ganging from being bitten off by the sharp teeth of the fish. The gangings are 18 inches long. The hooks, of which there were six on the section of trawl line exhibited, are 4 inches long, $1\frac{3}{16}$ inches spread from point to shank.

The following description has been given of a tunny trawl line used at Misaki:

It is a cord of about 1,250 feet, with ten snoods about 5 feet long, and is worked at a depth of more than 400 feet. Both the cord and the snoods are made of hemp and put into shallow sacks. Two boats, with 8 or 9 men each, usually work twelve basketfuls of the cord. To use it, five stones, weighing about 27 ounces apiece, are tied to the cord; also at each end of it is attached, by means of a cord about 30 feet long, a rod of *Paulownia imperialis*. To these again is tied at right angles a long stem of bamboo, at the top of which some easily observable signals are placed. The principal cord does not reach the bottom of the sea, but is kept suspended at some intermediate depth. For bait, squids and horse mackerel are used.[2]

[1] Catalogue of exhibits relating to the Fisheries of Japan at the World's Columbian Exposition, p. 5.

[2] Ib., p. 10.

Cod trawl line.—A section of trawl line used for the capture of small cod was exhibited in one of the characteristic circular shallow baskets (fig. 298). It had a two-stranded tanned ground line about the size of the pollock hand lines used by New England fishermen: the gangings were the size of a mackerel line, and each 4 feet long. This section had 50 Kirby-bend hooks, 1¼ inches long. Fastened to the ground line at regular intervals were 11 wooden floats, each 3½ inches long, 1¾ inches wide, and ¾ inch thick. To counterbalance these, there were 6 stone sinkers, each 2½ to 3½ inches long. Several sections like this are bent together to form a complete line.

In the vicinity of Niigata the trawl lines employed in the cod fishery are usually in sections, about 255 feet long, and each section has 55 gangings, each 2 feet in length.

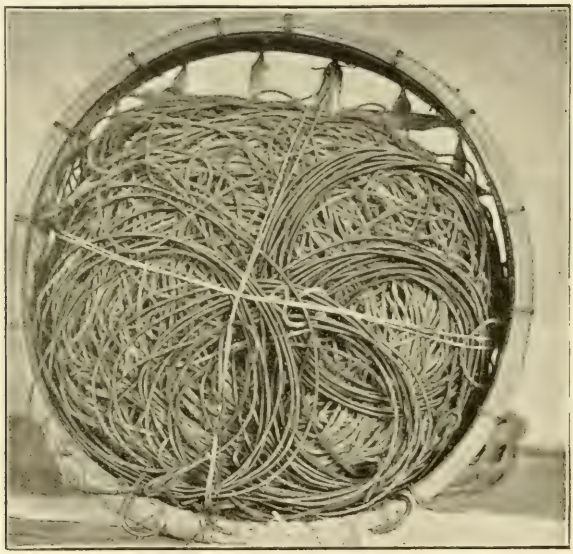


FIG. 299.—Shark trawl line.

Such a line is put into a shallow basket made of bamboo, and is called a "maki." A boat with a crew of six men uses 80 such maki tied end to end into a single line. At each end and in the middle of this line is tied a stone and a barrel buoy, the latter by means of a cord; also at the end of each maki are attached alternately a stone and a float, so that the whole line may not lie flat on the bottom but be kept floating at intervals. For bait, sardines and squids, cut into pieces of convenient size, are used.

Shark trawl line.—A section of trawl line used in the shark fishery, which was exhibited, was coiled in a circular bamboo basket (fig. 299), like the others. On one side of the rim is a bunch of soft strips into which the hooks are stuck, for this is the customary way of disposing of the hooks on practically all varieties of trawl lines.

Three-stranded hard-laid tanned line, nine-sixteenths inch in circumference, is used for the ground line. This section had 6 hooks, 4 inches long, bent to gangings about 30 feet long. Great care is observed in the preparation of these gangings to prevent them from being cut by the sharp teeth of the sharks, or chafed by their rough skin. Each snood is served with copper wire for a length of 23½ feet; 4½ feet of its length is made of hard-laid rope served with blue cotton, and next the hook are three stout copper-wire links, each 9 inches long.

Eel trawl line.—Trawl lines are used for eel fishing in Japan. A section exhibited had a tanned cotton ground line and white cotton gangings, the latter being 4 feet long. It had 122 hooks, each three-fourths inch long. It was coiled in a circular basket, 15 inches in diameter and 7 inches deep (fig. 300). Several of these sections may be united in one trawl-line.

FIG. 300.—Eel long line.

Mackerel trawl line. — Long lines are used in the mackerel fishery at Misaki, in the province of Sagami. One of these lines is about 350 feet long, and has attached to it 85 snoods, each about 2 feet in length. Fourteen baskets of this line are usually worked by a boat with a crew of 6 or 7 men. When being used, the line is kept floating at some intermediate depth by means of five barrel buoys attached to the principal line by means of ropes 300 to 350 feet long. As ballast, a small stone is tied to the lower end of each hanging rope. Besides these, nine smaller stones are attached at intervals to the whole line.

Hand-line fishing appliances.—Few countries have such varied, peculiar, and effective forms of hand-line fishing gear as Japan, and it is evident that much skill and ingenuity have been expended in producing many of these devices, the preparation of which often indicates keen observation of the habits of the species they are intended to capture. What has been accomplished is the result of centuries of experience, of observation, and of competition, which have combined to teach the fisherman what are the most effective appliances for the accomplishment of his object, having in mind his environment and such other conditions as must be met.

Tai fishing line.—The hand lines used in "tai" fishing are usually silk with a silk-worm gut leader at the lower end. A part of the

leader is coiled around a circular disk-shaped box of wood, and the silk line is reeled lengthwise on a bamboo rod.

The whole length of the line is 160 feet, of which the leader, 100 feet in length, is made of silk-worm gut, the remaining part being of silk. At three points a lead of one-tenth to one-fifth ounce is tied to hold the line against the currents. When the line is used, the bamboo rod on which the line was reeled is used as a fishing rod.[1]

Among the appliances exhibited was a hand-line gear for tai. This had a cylindrical lead sinker, 2 inches long and 1 inch thick, inside an egg-shaped cage made of wire and netting, the chief purpose of which was to hold the tole bait. A brass wire spreader, 20 inches long, was secured to the top of the sinker, and extending upward from the center of the spreader was a twisted wire, with a loop at its top for the line to bend into.

Bait cages, such as that mentioned, are commonly used in the tai hand-line fishery. These are crowded full of fine bait, tightly pressed in, and this soaks out gradually and drifts off with the current so that the schools of fish following up the stream of bait to the source of supply come to the fishing gear, where they are liable to be caught. It is interesting to note that the Norwegians have a similar but somewhat cruder device for distributing bait and attracting fish.

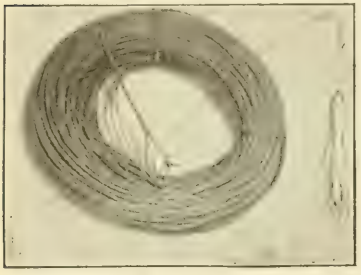


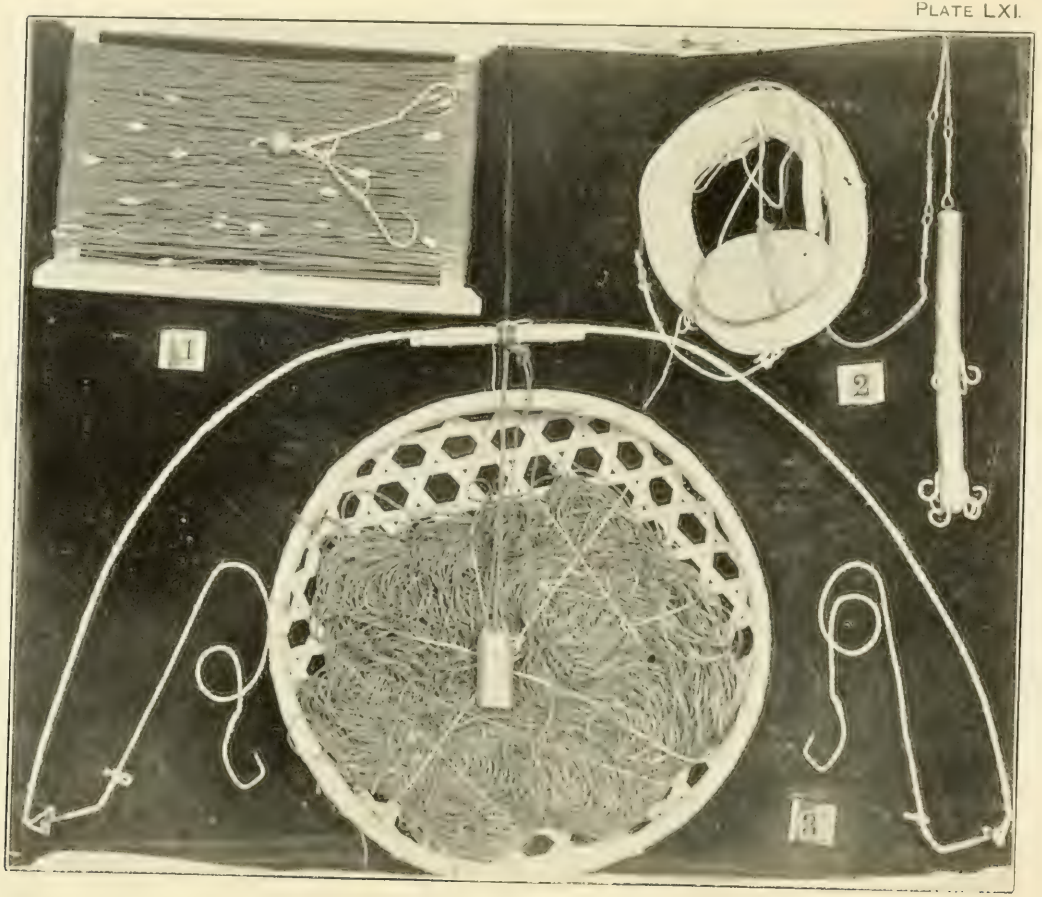
FIG. 301.—Bonito trolling line.

Bonito trolling line.—A bonito trolling line (fig. 301), with artificial bait, was exhibited. The line is about 230 feet long and $\frac{3}{8}$ inch in circumference. At the lower end of the line is a wire snood, 22 feet long, served with raw fiber. The hook is 2 inches long, and has around it strips of of fish skin, bleached white, 6 inches long. These strips are fastened to a hollow piece of bamboo that slides free on the snood above the hook. The cylindrical cartridge-shaped sinker of bone and metal has the snood rove through it so that it moves freely, and the lower portion is hollowed out so that it fits down over the bamboo to which the lure is fastened.

This form of lure is made to resemble a squid. Another kind of artificial bait is made in imitation of a sardine. Hooks with real bait are used for catching bonito, which are frequently still-baited by throwing sardines in the water.

Yellow-tail line. The hand line used for trolling for the yellow-tail (*Seriola quinqueradiata*) in the China Sea from the coast of southern Japan, is shown in figure 1, Plate LXI. The line is a trifle larger than the American mackerel line, and is wound on an oblong wooden reel.

[1] Catalogue of Exhibits relating to the Fisheries of Japan at the World's Columbian Exposition, p. 5.



FISHING GEAR

On this line are small lead sinkers, about 15 to 30 inches apart, those at the bottom end of the line being nearest together, and the distance increasing about an inch with each succeeding pair. At the end of the line is a brass wire snell, 10 inches long, which bends into the line loop in the upper part of the small pear-shaped lead sinker. There are two hooks, each 2½ inches long, on stiff hemp snoods, each 5 inches long.

Mutsu hand line.—Hand-line fishing for the mutsu (*Scombrops chirodipteroides*) is prosecuted in the deep sea, in depths usually exceeding 300 fathoms. A fine 2-stranded silk or linen line is used; this is coiled in a shallow circular basket like those used for trawl lines (fig. 3, Pl. LXI).

The gear consists of a cylindrical lead sinker (2 inches long and 1½ inches in diameter) attached to the middle of a bamboo spreader, 6 feet long, by lines 8½ inches long, so that the lead hangs below the spreader. The latter has a short, stout piece in the center to stiffen it where the line bends to it. There is a line loop at each end of the spreader, into which the silk-line snood bends. The hooks are made of brass, are bent in angular form, and have the general shape of the American center-draft hook.

Plaice line.—The hand line used for catching plaice is similar to that above described. This is a double coil line about 50 fathoms long, bearing 30 pieces of lead each weighing about 2½ ounces. These pieces of lead serve to hold the line against the current. The distances between them grow less and less as we approach the hook. To the hook is attached a flat, circular piece of lead, and besides this there is a long line for tying the bait, for which sardines, either fresh or salted, are used.

Horse-mackerel line.—The hand-line gear (fig. 3, Pl. LXII) used for catching horse mackerel[1] is well made. The line, which is the size of our ordinary mackerel line, is coiled in a small, shallow, circular basket. It has a conical lead sinker, 3½ inches long (weight about one-half pound), with a curved brass wire spreader, the upper part of which is seized to the top of the sinker and extends above it, forming a loop for the line to bend into. The ends of the spreader are separated 11 inches. To the ends of the spreader are bent horse-hair or gut snoods, 4½ feet long. Small galvanized hooks (three-eighths inch long) are used. At the top of the sinker is a net bag (3½ inches long and 1½ inches diameter at top), for holding tole bait, which gradually soaks out and attracts the fish.

[1] I was unable to learn definitely the scientific name of the species to which the common name of "horse mackerel" has been applied by the Japanese. It is evident, however, that it is not intended to designate either of the tunnies, since the line is too small for their capture. It is quite possible the *Auxis rohai* Risso, which is smaller than the mackerel (*Scomber scombrus*), or perhaps the little bonito (*Auxis tapeinosoma*), are the species taken with this gear, since these are migratory fish that come to the coast waters in spring, and the largest specimens rarely exceed 17 or 18 inches in length.

Mackerel hand lines.—A specimen of the hand line used for the capture of the Japanese mackerel (*Scomber colias*) was exhibited. The line which was wound on an oblong reel (fig. 2, Pl. LXII), similar to the small cod-line reels common in New England, is about the same size as American mackerel line, and is tanned. The gear is like that for the horse mackerel. The conical sinker is 3 inches long, the ends of the curved wire spreader are 16 inches apart, the twisted gut snoods are 4 feet 4 inches long, and at the lower end of each is a fine double-gut ganging, 10 inches long, to which is bent a brass hook, 1 inch long and $\frac{5}{8}$ inch spread, from point to shank. There is a net bag (like fig. 4, Pl. LXII) for tole bait at top of sinker.

The hand-line gear used for mackerel fishing at Misaki consists of a piece of brass wire bent in the middle so as to form a loop, the two ends of which diverge from each other. The wire is then attached by the loop to a line consisting of three strands coiled together, and measuring about 250 feet in length. Each end of the wire bears a snood of silkworm gut, and to the loop are attached a conical piece of lead and a bag containing bait.

FIG. 302.—Shore hand line.

This line is worked by night and at a depth of 10 to 50 fathoms with good tidal currents, large shoals being made to gather by torch or lamplight.

For bait, sardines and mackerel are chiefly used. When these can not be obtained fresh salt sardines or salt mackerel are used. The small bag attached to the loop contains minced flesh of these fish, which acts as a tole bait.

The mackerel is caught in considerable numbers in the spring and autumn, but also more or less throughout the year.

Mullet drift line.—This line is employed for the capture of the gray mullet in a lake having brackish water, and is operated from a boat.

The line is made of hairs from horse tails, twisted together to the thickness of about one line, and 120 to 140 yards in total length. Hooks, about ten in number, are attached to the line by means of short snoods. Moreover, there are many small, round floats attached to the line. The snood is provided with a long float made of wood near the point of attachment of the snood to the line. When a fish is caught on a hook, the long float belonging to the hook stands out of the surface of the water. The hooks are baited with earthworms. At the distal end of the line a

boat-shaped float with a sail is tied, by means of which the line is sent from the boat. This apparatus is used only for sport.[1]

The specimen exhibited (fig. 5, Pl. LXII) had 12 hooks, each 1¼ inches long; 12 wooden floats, each 1 foot long. The wooden boat-shaped buoy was 9 inches long and 3 inches wide, and had an iron keel and square sail.

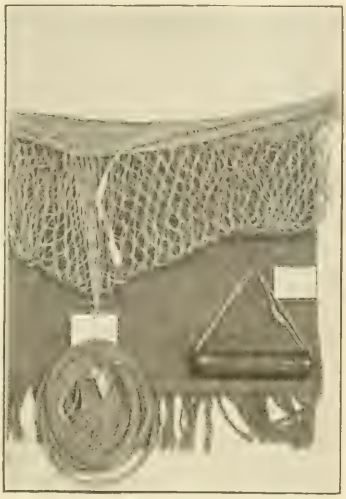


FIG. 303.—Shore cast line, etc.

Shore hand line.—A two-stranded grass line, about 100 fathoms long, is used for fishing along the shore (fig. 302). At the end of this line is a smaller two-stranded line, having attached to it 25 brass hooks, spaced 12 inches apart, and each on a snood 10 inches long. At the extreme end of this small line is a stone sinker of about 5 pounds weight. The hooks are 1⅝ inches long; their points turn in toward the shanks, so that they spread only one-fourth inch.

Shore cast line.—Among the exhibits of fishing gear was a cast line and accessories used in surf fishing from a shore (fig. 303). The line itself is in two sections. A short piece of heavy line is at the outer end to give weight and impetus for casting. Attached to this is a much smaller but longer line to which the hooks or lures are attached. When fishing the angler ties the apron shown in the illustration around his waist, the net bag for the fish hanging in front of it. The bone lures are carried in the small bamboo cylinder.

FIG. 304.—Sand-eel fishing gear.

Sand-eel fishing gear.—In pursuing the fishery for sand eels a device attached to a hand line is used, a sample of which was exhibited (fig. 304). The object of this is to frighten the fish, and the wooden "scarer" is the chief feature of the gear. This is an oval-shaped piece of wood, 10½ inches long by 3¼ inches wide, fastened to the line by a swivel hook. One side is painted black and the other is the natural color of the wood. It has a piece of abalone shell set into each side.

[1] The Gray Mullet Fishery in Japan, by Dr. K. Kishinouye, reprinted from Natural Science, Vol. XIII, No. 80, October, 1898, pp. 257, 258.

The cylindrical lead sinker, with a wedge-shaped upper end, is at the extreme end of the line, 16 inches from the "scarer." The line is wound on a reel.

Deep-water squid gear.—None of the fishing apparatus exhibited by Japan showed higher skill in its construction than the gear used for catching cuttle-fish or squid in deep water (fig. 1, Pl. LXII). The two-stranded line is the size of a small mackerel line, and is wound on a square frame reel. It has a cast and polished brass sinker, with loop at top to receive the line, and a bamboo horse or spreader in each of the two lower arms. Each of these is 13 inches long and their points are separated 20 inches. Fastened to the end of each is a gut snood 5 feet long, the lower end of which is bent to a squid jig. This jig is made by fastening a coronal of bent pins around the lower end of a small, round, wooden shank, 4 inches long. When these are moved in the water, by raising and lowering the apparatus, they somewhat resemble small fish and are eagerly seized by the squid, which are hooked by the pins.

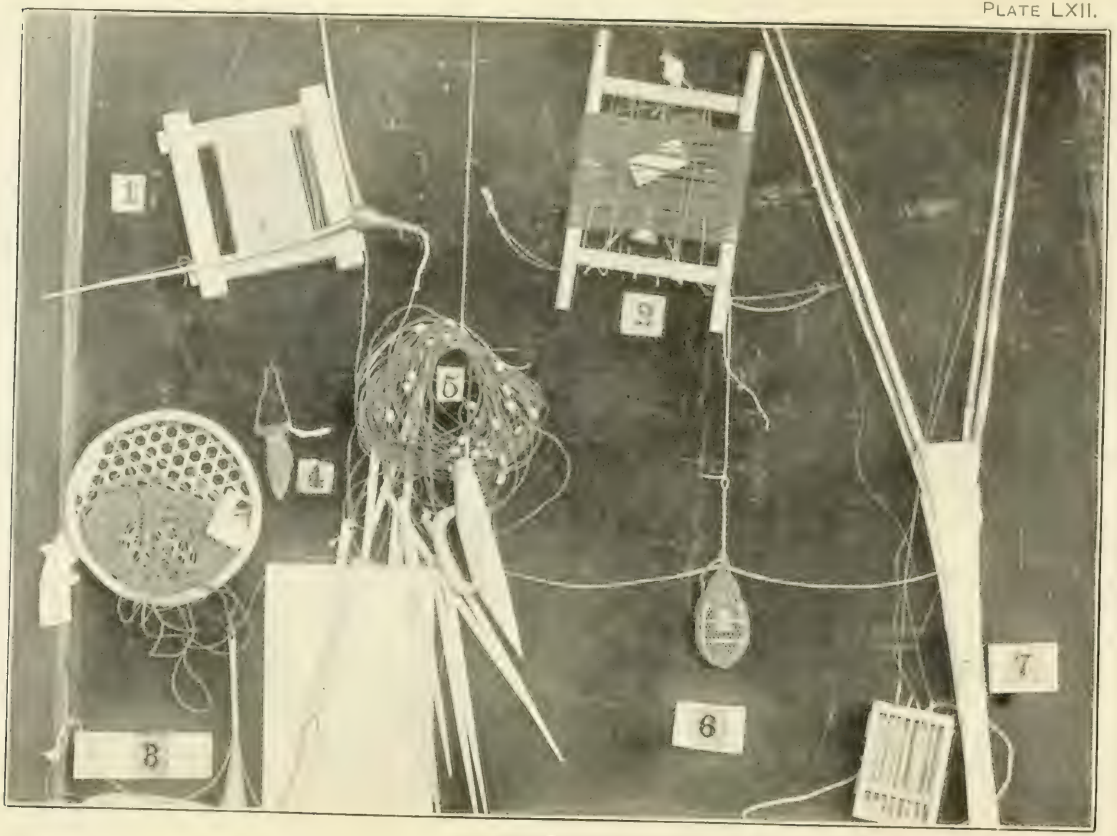
Surface squid gear.—The gear used for catching squid at the surface (fig. 7, Pl. LXII) differs entirely from that last described. A double-pronged fishing rod is used with a line and jig from each prong. The lines are made of gut, each 3 feet long. The handle of the pole is 16 inches long; the arms each 22 inches long. Brass-shanked jigs are used; these are 4½ inches long. When not in use they are held in a wooden box. When in use they are baited with squid and the bait is tied on.

Gear catcher.—This device (fig. 2, Pl. LXI) is intended to catch trawl lines or other gear that may have been sunk by the current or otherwise. It consists of a cylindrical bar of lead, 12½ inches long and 1¼ inches diameter, having two groups of wires bent into hook shapes, with their upper ends fast in the lead. At the upper end of the lead is a metal loop with a brass chain, 18 inches long, into which the line bends. A large stone sinker is bent to the line several feet above the "catcher."

To recover gear this device is lowered to the bottom, and when sufficient line has been veered out it is towed by a boat. If it comes in contact with trawl lines or nets it is liable to catch them, but is less efficient for this purpose than a device used for the same purpose by New England fishermen.

Hooks, jigs, and drails.—Possibly no part of the Japanese exhibit contained objects more characteristic or interesting than were embraced in the collection of hooks, jigs, drails, etc.

A striking feature of the Japanese hook is the shortness of the shank on some of them, and also the fact that many are made with the point turned toward the shank (Pl. LXIII). This last is a characteristic I have not seen emphasized so strongly elsewhere except in



FISHING GEAR

1, Deep-water squid gear; 2, mackerel hand line; 3, horse mackerel line; 4, bait bag; 5, mullet drift line; 6, Tai fishing gear; 7, Surface squid gear.

aboriginal hooks made of shells or other materials by the natives of the Pacific islands or of the northwest coast of America.

Some of the Japanese hooks are made of a pattern closely resembling that of the so-called center draft hook used in the sea fisheries of Europe and America, these indicating that the fishermen of Japan recognize the advantage of having a hook so formed that it will be surer to catch the fish by a pull on the line. Reference must be made to the illustrations of Japanese hooks accompanying this report for a better understanding of their varied shapes and peculiar patterns.

Wooden fish-shaped jigs (fig. 305) are in favor for catching squid, and these are made with much skill. The length varies from 5½ to upward of 6 inches. Fourteen pins are bent to the proper shape and securely fastened around a wooden shank which is firmly fixed in the lower end of the fish-shaped piece of wood. The latter is charred to give it color and is fitted with feathers to resemble fins. It is also banded or striped to heighten the deception.

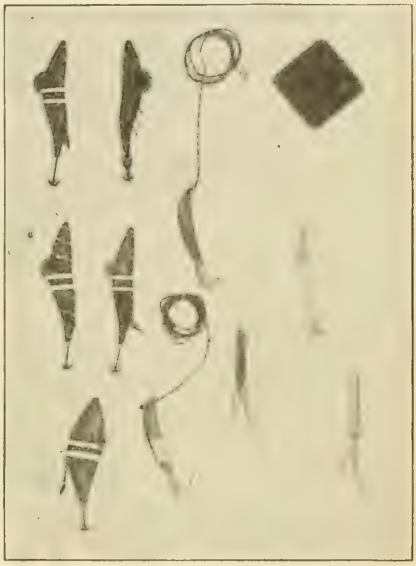


FIG. 305.—Squid jigs and lures

Various kinds of bone lures are shown on the same figure. These have bone sinkers, barbless brass hooks, and thin strips of white whalebone (baleen) around the hooks for a lure or artificial bait; one is shaped like a fish, others like a rifle cartridge, and two are boat-shaped. Some of the drails for large fish, like those in Plate LXIII, are provided with feather lures instead of bone. The Japanese are very skillful in the manufacture of small artificial flies for angling.

Pots, dredges, etc.—Many kinds of traps, pots, dredges, etc., are used in the fisheries of Japan, and several varieties were exhibited.

Prawn traps.—Three kinds of these pots were exhibited, two of them, however, differing only in size. These were cylindrical in form, made of split bamboo, with three funnel-shaped entrances placed tandem at one end, and a square head at the other; the head has a wooden lid which can be opened to remove the catch.

The smallest of these two pots was 18 inches long and 6 inches diameter; the largest (fig. 306) 23½ inches long and 8¾ inches diameter.

A short but wider trap is used for catching prawns (fig. 307). It is made of the same material as the others, with flat bottom and top, the former being somewhat larger than the latter. Instead of lying on its side, as the other pots do, this rests on its bottom when set for fishing, and the entrance is on one side, extending vertically from top to bottom. This is provided with two rows of fine bamboo splints, one on each side, which converge toward each other at their inner ends, so that, while the prawns may enter easily, they can not escape. This

FIG. 306.—Prawn trap.

trap is 10 inches high, 10 inches diameter at top, and 11¼ inches wide at bottom. The entrance is 1¾ inches wide on the outside.

Prawn pots are extensively used in Lake Biwa, in the province of Omi. They are baited with shellfish (*Corbicula* or *Paludina*), which is crushed and put into the pots. Dozens of the traps are then fastened to a long line, at regular intervals, and sunk to the bottom. From time to time they are raised and the shrimps in them are taken out.

Eel trap.—The eel traps exhibited are of simple construction. They consist simply of a section of bamboo, about 2 feet or more in length, with one end closed, a door on the side for removing the catch and a funnel-shaped entrance at the other end. The two shown were each 25½ inches long and 2½ inches diameter.

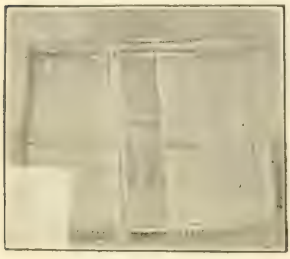


FIG. 307.—Prawn trap.

Cockle dredge.—A dredge such as is used for catching cockles has an oblong wooden frame, about 4 feet long and 15 inches high. The lower part of the frame, which rests on the bottom when in use, is armed with twenty long, pointed iron teeth, with their ends curved downward, so that they will dig into sand or mud and rake up anything on the bottom.

A stone sinker is fastened to each upright at the ends of the frame, and in the seizing that holds the stone is a rope becket into which is bent one leg of the bridle which the towing warp fastens to. The mouth of an oblong, bag-shaped net is fastened to the frame and tows behind it to receive the catch.

Anchors and killicks.—The four-pronged anchor or killick is greatly in favor in Japan and seems to be universally used in the fisheries.

Knives.—The Japanese have attained a high degree of excellence in the manufacture of knives used in the fisheries and the preparation of fishery products, and in this respect seem to be superior to some of the Europeans. Knives shown in figure 308 and Plate LXIV will convey a very good idea of this class of tools.

Methods of fishing.—The methods of fishing were in part represented by the attachment of models of boats to nets, etc., but were not otherwise shown. In the preceding descriptions of the apparatus reference has occasionally been made to the manipulation of the fish-

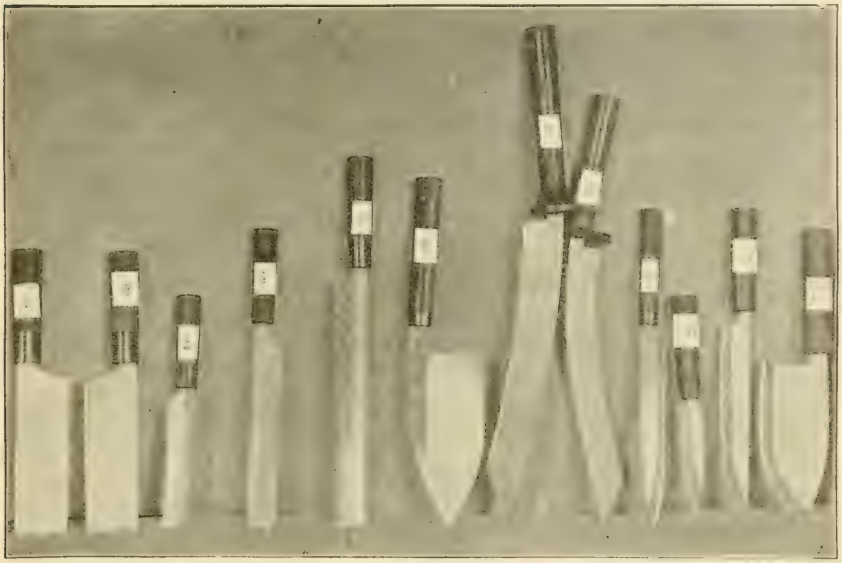


FIG. 308.—Fish knives. 1-5, fish-ball knives; 6-9, whale knives; 10, herring knife; 11, cod knife; 12, salmon knife.

ing gear, which gives some idea of the methods employed in certain fisheries.

Tai fishing.—The Japanese "scup" or "tai" is esteemed the highest of all food-fishes of Japan, and it is said that no feast can be complete without it. There are four species which are called "tai," namely, *Pagrus tumifrons*, *P. cardinalis*, *P. major*, and *P. ruber*. Of these, *P. cardinalis* is the most abundant. This closely resembles in appearance the red snapper of our southern waters. Fish of this species commonly found in the market are generally from 1 to 2 feet long. They are so highly prized that the fish 1 foot in length often sells for more than a yen.

As has been indicated, the "tai" is caught with hand lines, long lines, and nets. The great scare-cord net is used in the inland sea for

catching "tai," and the management of this is one of the most important fishery enterprises of the country.

In operating the scare-cord net nine boats are required. Two of these carry the apparatus and set it around a school of fish, substantially in the same manner that a purse seine is set for menhaden, the chief difference being that at the conclusion the boats pass each other so that the ends of the net lap. Also, the scare-cord net is usually set only once a day, the operation generally beginning not later than 8 a. m., while the American purse seine may be shot many times, and whenever the fish appear, quite regardless of the hour. It is even set at night for mackerel.

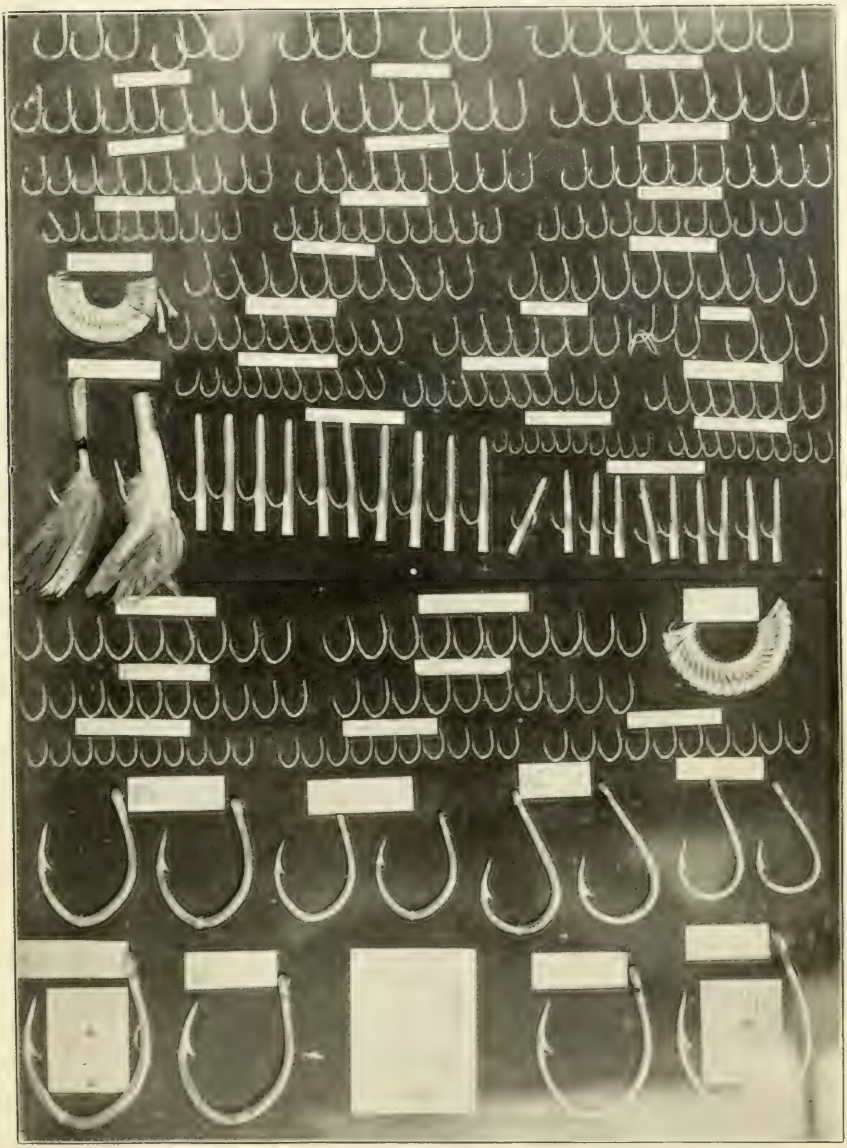
Much care is observed to have the net shot against the current, so that the tide will set into the bunt. As soon as practicable the "anchor boats" drop anchors to hold in position the ends of the net, to which lines are run. These anchors, in fact, hold the whole net and the purse boats that set it out, the crews of which gather in the wings at the proper time and gradually work the fish into the bunt, where they can be taken out. In the meantime the men in the two scare-cord boats are energetically working to drive the fish into the bunt of the net, and to keep them from going below the bottom of the wings and thus escaping. To accomplish this the scare-cord is kept in continuous motion, and the sinkers and wooden models of fish, with which it is armed, slash back and forth through the water between the lower edges of the wings of the net until the latter are gathered in.

Meanwhile a couple of oars have been tied by one end near to the middle of the bunt cork rope (which is supported by two large barrel buoys), so that the direction in which they float on the surface may indicate the set of the current. The captain's boat is back of the bunt, from which point all the operations can be most advantageously observed and directions given for the proper management of the net.

The boat carrying the merchant who buys the fish and the fish-carrying boat or boats lie quietly by, generally near the purse boats at the wings, for the men on them have little or nothing to do until the net is gathered in sufficiently to "dry up" the fish so that they may be bailed on board the boats, when they are promptly transferred and carried to market.

Bonito fishing.—In some respects the catching of bonito in the circle net resembles our purse-seine fishery. The net is equally divided in two boats, which go side by side until they separate to shoot the apparatus around a school of fish, when they circle around precisely as boats do in setting the purse seine. Each skipper, however, is up on a sort of ladder at the stern of his boat, 4 or 5 feet higher than the other men, so that he can better watch the movements of the fish and direct his crew in rowing.

When the net has been shot, every effort is made to gather it in



HOOKS AND LURES

around the school of fish, and to "tuck it up," as it is called, so that the bottom of the net may be brought beneath the fish, and thus prevent the possibility of their escape. When this has been accomplished the rest of the proceedings is very similar to the manipulation of a purse seine. The fishermen keep pulling in on the net until the fish are brought into a compact mass in the bunt, when they are dipped out into the boats.

In hand-line fishing for bonito off Shiwono-misaki, in the province of Kii, the fish are toled up with bait. One man stands in the middle of the boat and with a dipper throws sardines into the water to attract the fish. The fishermen hold their fishing rods in one hand, and with the other, by means of spatulas attached to long bamboo rods, they continuously throw water over the surface where the bait is. The object of this is to prevent the fish from seeing the line and hook, and thus to more surely decoy them into biting. When caught the bonito must generally be lifted in with a gaff, and it is customary for a Japanese fisherman to hold one of these fish under his arm while removing the hook from it.

Cod fishing.—The cod fishery is mostly prosecuted in January and February, at which season the fish come near the shore for spawning. Sometimes the cod come into water as shallow as 15 fathoms, but in other places they are never found in less than about 100 to 110 fathoms. As has been intimated, trawl lines are chiefly used in the cod fishery. These are set out from the boats in long strings in a manner very similar to that adopted in the American fisheries, and at a suitable time the lines are hauled back and the fish are removed.

Nets are used to some extent for catching cod along the shores of the Japan Sea. Several of them are fastened together and set in a string at the bottom of the sea, as in Norway or elsewhere, where the cod is taken in this form of apparatus.

Sardine tuck-seine fishing.—The tuck seine is set for sardines in the same manner as the bonito circle net, so as to inclose the school of fish in the circle formed by the seine. A peculiar form of net is used for this fishery resembling a large sack. When it is set out one end floats and the other end is pulled through by boats on the opposite side until it passes underneath the school, when it is gradually lifted to the surface, so as to bring the fish into the bunt of the net. In this way the same result is accomplished as is attained by using the purse seine. The native name of the fish taken in this manner is "iwashi" (*Clupea melanosticta*).

The sardine is the most important of the useful fish of Japan, and the economic condition of the whole fishing industry is intimately connected with the amount of its catch. This is due to the fact that the sardine always comes in enormous shoals and is caught almost everywhere along the coast. Large areas of the surface of the sea are sometimes changed in color by the presence of a single shoal. The sardine is a migratory fish, going from south to north in spring and returning again to the south

in autumn. The shoal usually swims at the surface against the current, but is said to also sink at times to the bottom. The sardine feeds on small crustaceans, such as *Mysis*, and is attracted by torchlight. Spawning takes place in the spring.[1]

Sardine circle-net fishing.—The manipulation of the sardine circle net does not differ materially from the methods already described. The net is run around the fish in a circle, and then the ends are hauled in or "tucked up" until the fish are all brought into a bag or pouch at the bunt, after which they are dipped out.

Mackerel fishing.—The three principal methods adopted in Japan for the capture of mackerel are hand-line fishing, long-line fishing, and net fishing.

The hand-line fishery is often conducted at night by torchlight, by which large schools of mackerel are brought together. Sometimes lamplight may be used instead of torches. The hand-line is used to depths of 10 to 50 fathoms in good tidal currents, according to Japanese writers, but it is difficult to understand the need of fishing so deep when the fish are attracted by a light or by tole bait.

Mackerel and sardines are used for bait; if these can not be obtained fresh, salted fish are taken. The tole bait, which is put into a small bag or net-and-wire cage, consists of the minced flesh of the sardine or mackerel. It will be understood that the tole bait is not thrown out into the water, as is the practice in the United States, to attract the fish to the surface, where they can be taken with short lines, but it is used only in small quantities on the gear, that is lowered down to a depth where they are supposed to be.

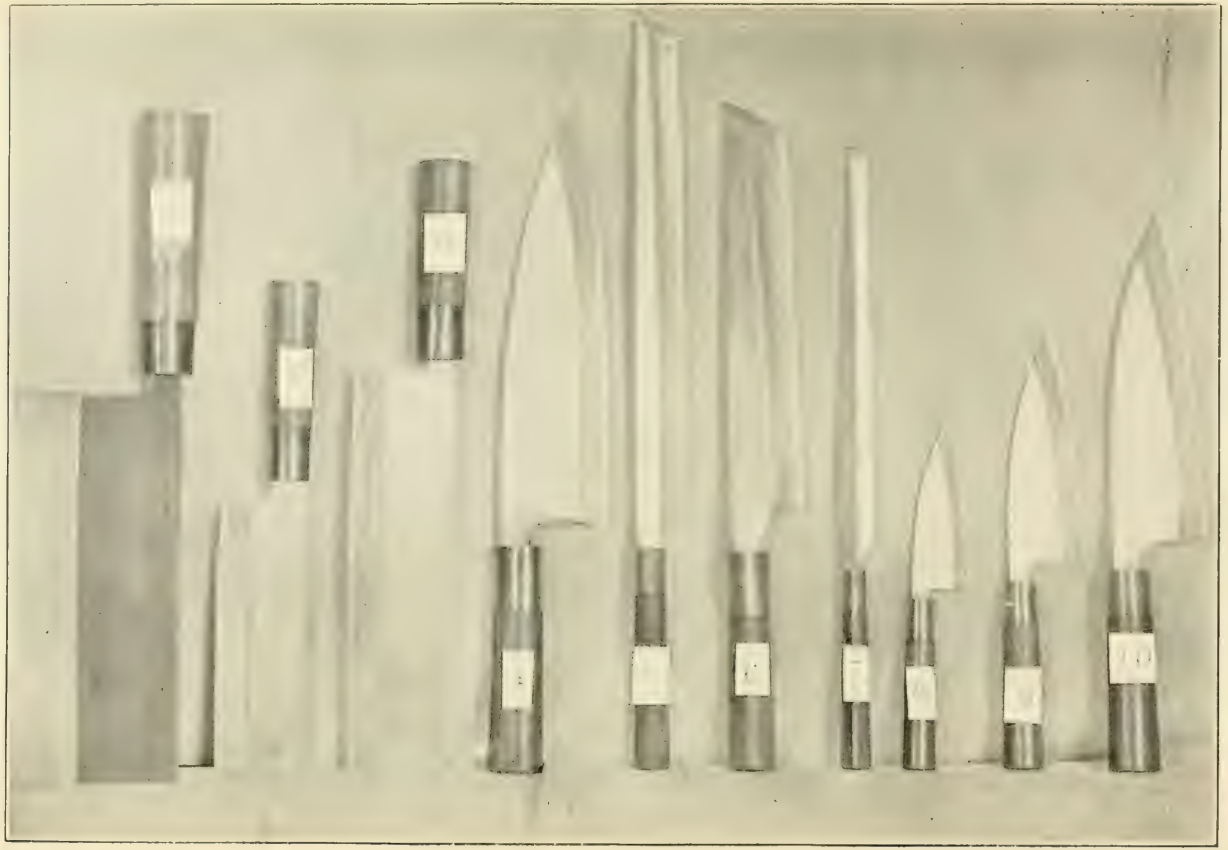
The trawl line is set so that it will float at some intermediate depth, and is supported by five barrel buoys, and with a buoy line from 300 to 350 feet long bent to the trawl line at regular intervals. At the lower end of each buoy line is a small stone sinker. In addition there are nine smaller stones bent to the trawl line at regular intervals.

The net fishing depends for success on attracting schools of mackerel with torchlights, a method which has been practiced in Japan for four centuries or more.

The rectangular net is held in a flat position some distance below the surface by four boats pulling on the ropes fastened to its sides. Two other boats armed with blazing dragons row about in the vicinity until they have each attracted a school of fish, when they steer for the middle of the net, the mackerel following the torches. Then the fishermen in the four boats pull up quickly on the sides of the net to inclose the fish, the torches are extinguished, and the boats that carried them row out of the net. The latter is then gradually gathered in until the fish can be taken out.

Products.—The exhibits of products were rather limited. The most

[1] Catalogue of Exhibits relating to the Fisheries of Japan at the World's Columbian Exposition, pp. 25–26.



FISH KNIVES.

1–3. Fish-ball knives; 4–10, fish-cooking knives.

notable objects under this head were canned salmon, oysters, sardines, eels, etc. The canned salmon exhibited by Tatsujiro Fujino and Rinta Mizushima were of excellent quality, while the canned oysters shown by Uhichi Kita, the fish soup by Kosan Kwaisha, and the sardines in oil by the Matsuda Fish Cannery deserve mention.

The Yokohama Fish Oil Company exhibited various kinds of oil, and S. Ito had a small collection of medicinal cod-liver oil.

Adhesive paper prepared with fish glue, samples of pearl oysters and pearls, and objects made from turtle-shell were among the noticeable products of the fisheries. The Japanese excel in the manufacture

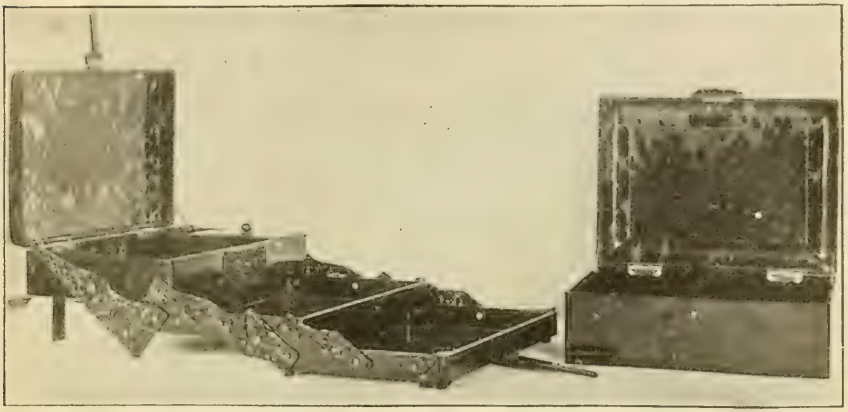


FIG. 309.—Toilet box and jewel case.

of various ornamental or useful articles from turtle-shell. Among these were ladies' toilet extension boxes and jewel cases (fig. 309), ladies' hat pins, fan frames, photograph frames, and various other things.

ENGLAND.

General considerations.—Among the countries unofficially represented England unquestionably had the most important and instructive exhibits. Inasmuch, however, as these were wholly private collections, and each exhibitor was naturally concerned solely in exploiting his own wares or business, it was scarcely to be expected that the British display would embrace objects included in more than a few of the groups and classes of the official classification.

Great Britain is, par excellence, the builder of the most approved forms of modern fishing vessels and other steam craft used in connection with European fisheries. It is also prominent in furnishing equipments of all kinds for these, from the smallest implement to an otter net, or a steam winch for operating it. It was, therefore, in harmony with the fitness of things that the collections exhibited were largely, if not exclusively, representative of the building, repairing, and equipment of fishing vessels.

The recent notable development of the British market fisheries, the advance in the methods of caring for fish on shipboard, the change from sailing to steam vessels, and the improvement in the equipments for men and fleets are remarkable phases of the fishing industry of Great Britain which deserve special study and consideration, particularly in view of the decadent condition of American deep-sea fisheries. Indeed, so strongly did this impress me, and so important did it seem to the welfare and continuance of our Atlantic sea fisheries, that after the close of the exhibition I visited some of the most important fish markets in Scotland and England for the purpose of study and observation.

Vessels.—The firm of Edwards Brothers, of North Shields, exhibited a most interesting and instructive collection of models and photographs

FIG. 310.—Steam trawler Hawk. (Exhibit of Edwards Brothers.)

of fishing steamers built by them, which represented the leading features of this class of British-built vessels. Those exhibited were mostly models of trawlers, which range from 90 to 110 feet in length. These have been the usual limits of size, but recently larger vessels are in demand, and some trawlers are several feet longer; few are now built less than 100 feet in length, while the welled long-line steamers that fish at Faroe and Iceland, and bring home fares of living and iced fish, have sometimes exceeded 125 feet in length between uprights. The small trawlers, like the *Hawk* (fig. 310), are generally for inshore fishing, while those like the *Lucerne*, of 107 feet in length (fig. 311), visit the distant fishing grounds and encounter all conditions of sea and weather.

The British fishing steamer is usually built of iron; sometimes steel is used instead, but as there is not the same necessity for limiting the

weight of the hull as in the case of a large merchant vessel, steel has not been extensively employed in constructing steamers for fishing. For details of construction of this class of vessels reference is made to the "Report on the British beam-trawl fishery," etc., and "Suggestions for the improvement of fishing vessels," published some years ago by the writer in the bulletins of the United States Fish Commission.[1]

The typical fishing steamer has a moderately sharp bow, flaring slightly above water; stem straight and nearly vertical above water, curved below; rising floor (there is considerable variation in the midsection, some steamers being appreciably sharper on the floor than others, but most of them are substantially alike in the angle of rise, which is usually moderate); rather easy bilge, with or without bilge keels (the vessels built by Edwards Brothers have bilge keels, which increase their steadiness in a seaway); well-formed run of medium length; four-bladed single propeller screw; round-heeled rudder, and overhanging round stern. The sheer is a remarkable feature, the bow standing up high and bold to breast the waves, but the stern is much lower. Some steamers have a flush deck, but a quarter deck of varying length and height is common. Sometimes there is a raised forecastle deck. Generally the smokestack stands approximately three-fifths the vessel's length from the stem head, but sometimes it may be either farther aft or forward. The cabin is aft, and the forecastle under deck forward. The boat is usually stowed in chocks abaft the mizzenmast. The bridge is 7 or 8 feet above deck, immediately forward of the mizzenmast, and is reached by steps. Recently the tendency is to have a pilot house forward of the smokestack, as on the *Lucerne*, and sometimes there is a bridge or outlook on top of it.[2] Steam steering gear has been put on the most modern fishing steamers.

The steam winch for heaving in the steel trawl warps usually is a little forward of amidships on the main deck. The trawl warps pass

[1] The Beam-Trawl Fishery of Great Britian, with notes on Beam-Trawling in other European Countries, by J. W. Collins, U. S. Fish Com. Bull., Vol. 7, pp. 289–407.

Suggestions for the employment of improved types of vessels in the Market Fisheries, with notes on British Fishing steamers, U. S. Fish Com. Bull., Vol. 8, pp. 175–192.

[2] There is considerable diversity of opinion as to the relative merits of the bridge and pilot house on fishing steamers. Some contend that it is more humane and better to have the fishermen as comfortably provided for as practicable, especially while steering in cold, fierce winds, when exposure to the chilling blasts and driving sleet and spume on a bridge is, to say the least, cruel punishment that taxes human endurance to the utmost.

On the other hand, it is urged that being protected in a pilot house is "too soft a job" for the wheelsman who, because he is more comfortable, may fall asleep, to the great peril of his vessel and shipmates, not to speak of the danger to other vessels which such negligence involves. However, the pilot house is gradually superseding the bridge, and doubtless the prejudice of conservatism will yield more and more to the innovation that seeks to improve the comfort of the fishermen.

around iron or steel bollards and thence over rollers in the sides. Two trawls are used, one on each side, but not at the same time. When one trawl is hove in, and while the men are busy clearing it of fish and getting it ready to shoot again—possibly repairing damages—the other is shot, and thus no time for fishing is lost.

On each side forward of the main rigging and on the quarter, 15 or 20 feet from the stern, are iron derricks or davits, with pulleys attached, for lifting the otters over the rails and bringing them in on deck. Abreast of these on the sides of the vessel are chafing bands for preventing chafe from the trawl otters, and usually one or more of these bands extend along the midship section also, where the trawl net comes in.

The forecastle has eight berths, and the cabin usually has six. Over the cabin is a raised skylight. The engine room is immediately for-

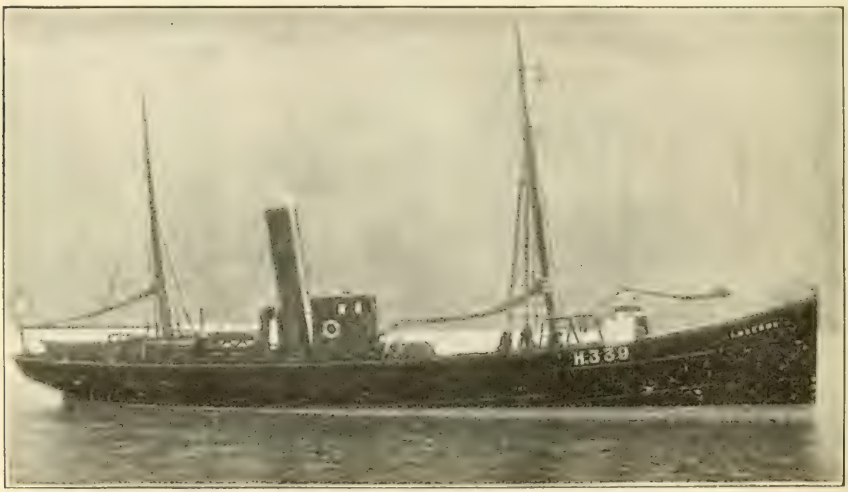
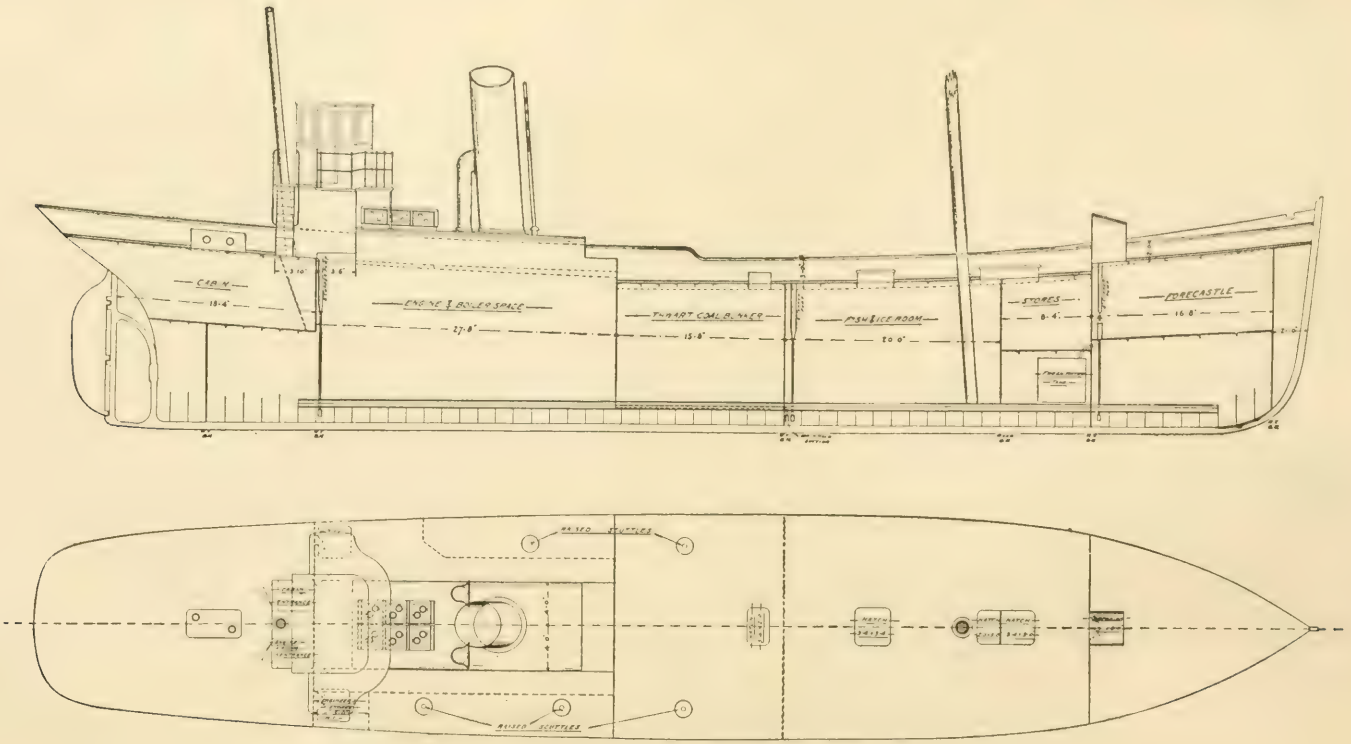


FIG. 311.—Steam trawler Lucerne. (Exhibit of Edwards Brothers.)

ward of the cabin, and the boiler room next forward of that. The fish room and ice pens are between the forecastle and boiler room.

Some of the above-mentioned details of equipment are not commonly found on the steamers employed in the long-line fisheries, but it is possible for a vessel to be fitted so that she is available for trawling and for fishing with lines. Many of the liners, however, have wells for keeping fish alive. The details of deck and interior arrangement of steam trawlers are shown in Plate LXV. These are the plans of a steam trawler recently built by the firm of Cochran & Cooper, at Beverly, near Hull. It is about the average size now being built for deep-sea fisheries. The largest built by this firm in 1898 was a welled steam liner for fishing at Iceland in summer. She was 128 feet long over all, 21 feet 9 inches beam, and 12 feet depth of hold. She had bilge keels. Her plates were from one-half to five-eighths inch thick. I am



SHEER PLAN AND DECK PLAN OF STEAM TRAWLER, BUILT BY COCHRAN AND COOPER.

indebted to Messrs. Cochran & Cooper for courtesies, among which was the gift of the plans published herewith.[1]

The rig of the fishing steamer is what is called the "dandy rig" in England. In the United States it would probably be called a schooner rig.

It consists of two pole masts, the mainmast being considerably longer than the mizzenmast. No bowsprit is carried; the mainstay and main topmast-stay set up at the stemhead. Three sails are commonly carried—jib or staysail, mainsail, and mizzen. The latter two are often boom and gaff sails, but it is becoming customary to have leg-o'-mutton mainsails and mizzens, which are preferred by many, since their use avoids the jerk of gaffs in a rolling sea. Sometimes two jibs are used. Sails are not, however, much depended on, though they assist considerably sometimes with fresh or strong leading winds, especially on long passages.

The Grimsby steamers usually have triple-expansion engines of 285 to 450 indicated horsepower, and a speed, under steam alone, of 9½ to 10½ knots.

The steam liner *Phalarope*, of Aberdeen, 103 feet long, 20 feet beam, and 11 feet deep, had upright compound engines of 285 indicated horsepower, 21-inch stroke, 110 revolutions per minute; multitubular boilers; 10 knots speed, and consumed 2½ tons coal per day at full speed.

A welled vessel costs about $1,000 more than a trawler. A welled steamer, 128 feet long, 21 feet 6 inches beam, 12 feet depth of hold, complete for sea, with triple-expansion engines, boiler 11 by 10 feet, 180 pounds working pressure—tested to 350 pounds—with complete set of fishing lines, costs $30,000. A steam trawler of the same size, ready for sea, including two sets of trawls and spare gear, costs $29,000, but a trawler 100 feet long costs only about $20,000. These figures do not include cost of coal, ice, or provisions.

The vessels up to 112 to 114 feet in length, built at Beverly, had triple-expansion engines of 350 indicated horsepower, but those 120 feet long had engines from 400 to 450 horsepower, and a speed of 10 to 10½ knots, with an expenditure of 3½ tons of coal per day.

Following are the relative dimensions of a steam trawler: Length over all, 111 feet; beam, extreme, 20 feet; depth of hold, 10 feet 8 inches; stem to mainmast, 28 feet 6 inches; length of forecastle deck,

[1]As an indication of the remarkable prosperity of the fishing trade, and the effort that is being made in England to increase the steam-fishing fleet, it may be stated that in 1898 Messrs. Cochran & Cooper launched 35 fishing steamers at an average cost approximating $27,000 each, and had orders booked for 1899 for 41 vessels of that class. When one firm in a small town like Beverly finds about a million dollars worth of business annually in building fishing vessels, the condition is one that deserves the attention of American fishing interests.

18 feet 6 inches; mainmast to smokestack, 33 feet; mizzenmast forward of taffrail, 20 feet; mainmast above rail, 48 feet; mainboom, 29 feet; smokestack, above rail, 20 feet; bridge, above deck, 6 feet 6 inches; mizzenmast above rail, 35 feet; spanker boom, 22 feet.

There were no exhibits of sailing fishing vessels, for the reason that few, if any, are now built for trawling or the long-line fishery, and owners of those still employed are anxious to dispose of them. It is true that extensive fleets of ketch-rigged cutters still operate beam trawls. Grimsby alone had approximately 300 vessels of this class in 1898, but they are rapidly being superseded and sold for other trades, and their places are being filled by steam vessels, which are so much more effective that it is considered one steamer is equal in productive capacity to five sailing smacks.[1]

It is difficult to realize the change which has taken place since 1883, when the International Fisheries Exhibition was held in London. At that time steamers were being introduced to a limited extent and more or less experimentally, and the model of the sailing cutter *Frank Buckland* (Pl. LXVI) was given the highest award as the best representative type of a beam trawler. But sail had to yield to steam, despite the deterrent influence of invested interests, and the effort has been to sell the sail-driven vessels as fast as practicable and supply their places with steamers. This is evidenced by the fact that the steam fleet of Grimsby numbered about 300 vessels in 1898. When we consider that this is the creation of only fifteen years of effort—for Grimsby had only two or three steam fishing vessels in 1883—and that the capital invested in this piscatorial steam navy aggregates about $6,000,000 from this single port, the magnitude of the change and the importance of the industry are apparent. Nor should it be forgotton that the fleet is growing by leaps and bounds, as already indicated, and the present outlook suggests a development along this line in the immediate future if indeed it has not already occurred that may fairly be considered the most remarkable, as well as the most important, phase of the fishing industries of the world. When millions are annually devoted to increasing the steam-fishing fleet, it is not difficult to appreciate the influence which steam has had on the British fishing industry, while the immensity of the latter is indicated in no unmistakable manner.

Antifouling paint.—Closely associated with vessels, and particularly with steamers, is the question of preventing their bottoms from fouling. Therefore, the exhibit by the Holzapfels Composition Company, Limited, of anti-corrosive and anti-fouling compositions or paints for preserving and protecting the bottoms of iron or steel steamers, or copper paint for wooden fishing smacks, was appropriately placed near the collections representing fishing vessels. It is pertinent to remark

[1] At the time this is going through the press it can be stated that at the close of 1900 only 64 sailing vessels remained in the fishing fleet of Grimsby, while there had been a corresponding increase in the steam fleet, which numbered 486 vessels.

SAILING TRAWLER FRANK BUCKLAND.

Drawn by C. B. Hudson.

that these compositions are equally applicable to any steel, iron, or wooden surfaces which are immersed. These products are sold extensively in continental Europe.

Fishing gear and general outfits.—The exhibit of the Great Grimsby Coal, Salt, and Tanning Company, Limited, was not only interesting and instructive from the standpoint of embracing varied collections illustrating the business of equipment of fishing vessels and their crews, but the progressive development of the company itself epitomizes the changes and prosperity which have characterized the British fish trade in the past two or three decades.

The company was formed at Grimsby, in 1873, by owners of fishing smacks and their friends, the main object being to furnish their vessels with coal and salt, and provide suitable accommodation for tanning sails and nets, the tanning business being then an important part of the outfitting or preparatory stages for fishing. Hence the name was peculiarly appropriate for the time and the modest efforts for the first decade, but it fails now to convey an adequate conception of the scope or magnitude of the company's operations, and the remarkable diversity of materials furnished by it to its customers in various parts of Great Britain and the continent.

I knew it in 1880, before it attained pretentious proportions; its exhibit at London three years later indicated success in its initiatory stages, but from time to time different branches of industry or trade have been added, thus accelerating its development and increasing efficiency for equipment of men and fleets, until the claim is now made that it is "the largest firm in connection with the fishing trade in the world."

Again, in the autumn of 1898, when visiting Grimsby, on my return home from Bergen, I had the opportunity to inspect the various plants of this company, where a great variety of equipments are manufactured: from ganging hooks, making fishermen's clothing or lanterns for use at sea, to the building of steam engines, boilers, or steam capstans or winches. This was fully availed of and appreciated, for it supplemented the studies of the exhibit at Bergen, and led to a clearer comprehension of the work accomplished by the firm.

This may justly be referred to in detail since it offers a suggestion as to what may be accomplished in the United States in a similar direction by united effort intelligently directed. And the fact should not be lost sight of that the manufacturers in this case are largely the owners of fishing vessels, and the profits accruing do not go to outside parties, but add to the financial strength and permanency of the fishery industry.

The exhibit was divided into several groups or classes, to which only brief reference can be made. The most important included various objects of equipment for fishing vessels. Among these were trawl nets, fishing lines, sample bunches of ganged hooks for trawl lines—it

is customary to prepare these on shore—buoy lines, cordage of various kinds, including steel rope such as is used for rigging vessels or towing trawls; twines for making trawls, etc.; hooks of several kinds, winches for heaving in long lines, leads and lead lines, logs and log lines, nautical instruments of many kinds, marine clocks, spyglasses and marine glasses, barometers and thermometers, sailmakers' palms and needles, blocks, ships' signals; various tools ordinarily used on ship board, including knives employed in fisheries; implements for cooking, etc.

The collection of lanterns manufactured by the company was specially noticeable. The lanterns were skillfully made, mostly of copper, and seemed to be well designed for the several purposes for which they were intended. Among these were the common forms of running (port and starboard) lights, with dioptric and plain lenses; anchor lights; copper masthead steaming light; a triplex masthead fishing light, with dioptric lens, carried at masthead of steam trawlers when towing their nets; square deck lanterns, and several other varieties, including one designated as a "shooting lantern," used on fishing vessels when the gear is shot at night. A special pattern of buoy lantern had two lugs on one side with rings to fit over the end of a buoy staff. This is used on net or line buoys set at night and is a most useful form of lantern, for it is of rather light weight and therefore can be supported at the top of a buoy staff, which is important, especially if the weather is rough, for the fishermen are thus better able to keep track of the position of their gear. Cargo lamps and lanterns, engine-room lamps, stern lanterns—to hang over the stern at certain times—gimbal lamps, and others are among those manufactured by this company.

The fog horns exhibited indicated no improvement over the forms ordinarily seen for sale.

An interesting feature of the exhibit was the collection of fishermen's clothing, boots and shoes, which are extensively manufactured by the company, and in considerable variety. The object is to have these materials strong, warm, and serviceable, rather than highly finished and attractive to the ordinary buyer. The heavier clothing is made of woolen stuff specially manufactured for the purpose. This applied particularly to the woolen "fear-naught" trousers, which are very thick and warm, as well as strong, and are preeminently serviceable and comfortable in winter weather. The woolen underwear, stockings, hand-knitted guernseys, Faroe guernseys, cardigan jackets, etc., partake of the same characteristics in greater or less degree, and one can but feel that garments specially made for the needs of fishermen are vastly better for them than anything we have in the United States, where no provision of this kind is made, and as a rule the fisherman utilizes at sea his more or less worn out "store clothes" that are no longer suitable to wear on shore.

Only passing allusion need be made to the oil clothing, which, like

all the European-made garments of this class, is much heavier than American-made oil clothes, and although of good quality, the standard is seemingly not so high as is found in the goods manufactured in New England. This would doubtless be most apparent in cold weather, when the European oil clothing must become very stiff, thus making it difficult to move about with it on, not to speak of its liability to break. But the fishermen, accustomed all their lives to such waterproof garments, seem to demand them; hence they are made.

Rubber clothing, made on the same patterns as the oiled garments for fishermen's use, is apparently unknown to British fishermen, although it has been used largely by American fishermen for many years, being preferred by many because its flexibility gives greater freedom of action in cold weather.

Photographs of the company's stores, the several branches of its manufacturing department, etc., added interest and instruction to the exhibit. But, as already stated, it was my privilege, through the courtesy of Mr. Harrison Mudd, president, and Mr. Charles F. Carter, secretary of the company, to see in actual operation the various branches of industry represented by the photographs, from the manufacture of fishermen's clothing to the coaling of a fishing steamer.

The original purpose of the company to supply coal and salt to the fishing fleet and to tan sails, etc., is still prominent, and the trade in coal has materially increased in recent years, due to the employment of so many steamers. Coal and salt are conveniently supplied from the company's premises to sailing vessels, which require only small amounts of fuel. Special arrangements have been made to meet the requirements for steam coal, which is quickly put on board from the "coal drops," or from lighters lying in one of the docks.

Sails are tanned in buildings near the fish docks, and since this is the universal method for preserving canvas and is extensively used for nets, the business is one of no insignificant proportions. Oak bark, cutch, tar, and ocher are the materials used.

Paint is manufactured, particularly a composition for vessel's bottoms.

The manufacture of twine, fishing lines, snoods, nets, including trawls, a patent "rounding" for trawl ground-ropes, etc., is another branch of work.

I was much impressed with the department devoted to engineering, boiler making and shipsmith's work (Pl. LXVII), for this not only emphasized the change which has taken place in the vessels themselves, but showed in no unmistakable manner the remarkable proportions to which the fish trade of Grimsby has attained. When one sees extensive and well-equipped works, and a large force of men devoted to the manufacture of boilers, engines, and numerous things required by fishing steamers, it is an object lesson that should not easily be

forgotten, for it not only indicates prosperity in the fisheries, but it shows how the successful management of them may build up other branches of industry and put into circulation no inconsiderable sums of money.

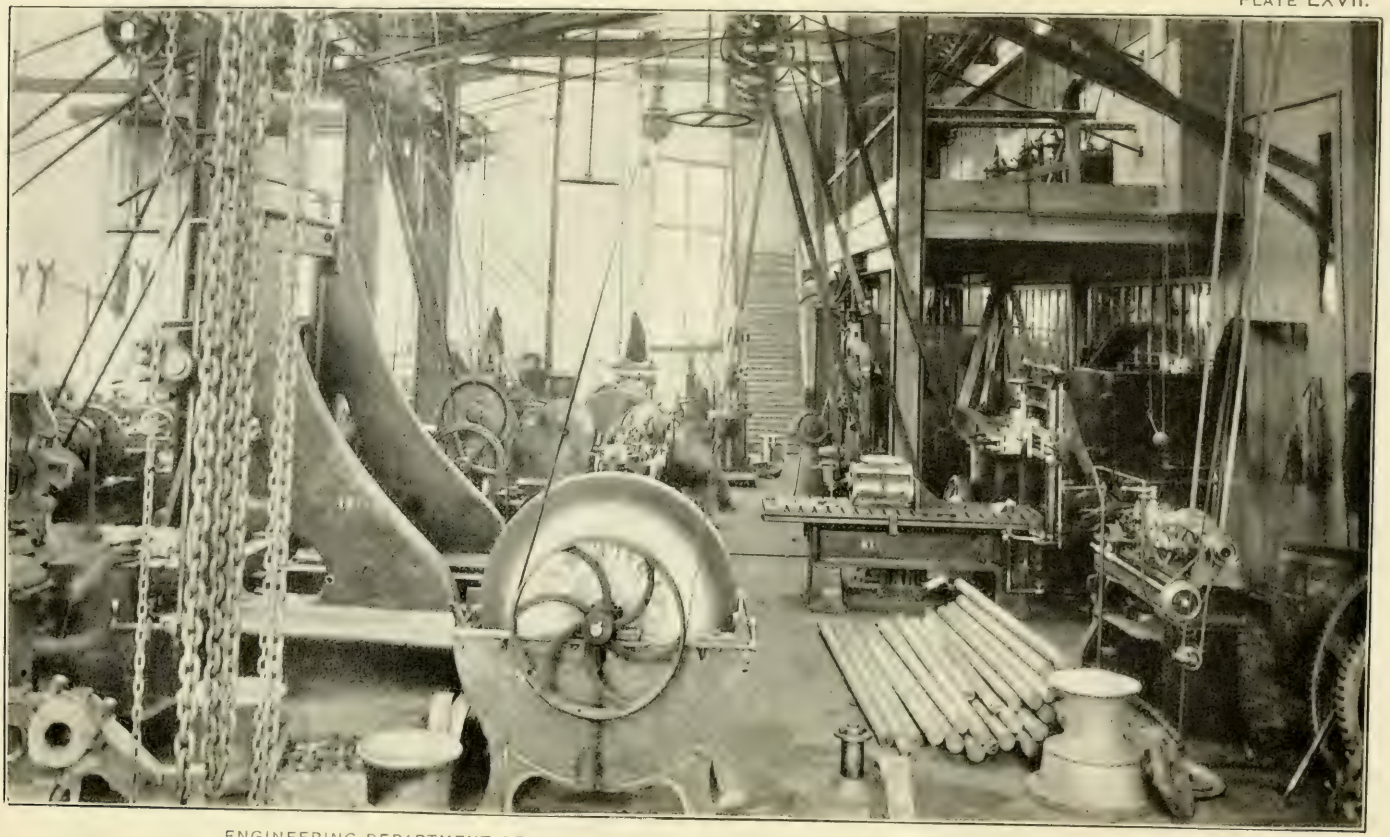
The rapid increase in the steam fishing fleet has resulted in many inventions to save time and labor in operating fishing gear and getting trawls on board—ordinarily called "boarding the fish." Thus there are various patented appliances, such as steam winches, gangway rollers, bollards, and "dandy" scores, which constitute an important part of the products of this establishment.

In the ironmongery section (Pl. LXIII) a great variety of useful and necessary articles are manufactured. An effort has been made to produce cooking utensils specially adapted to the requirements of fishing vessels. The lanterns and lamps have already been referred to at some length, but by seeing them in the process of manufacture and having the construction explained by skillful artisans one gains a better conception of what may be accomplished in the way of perfecting such things for special purposes.

After seeing the result of this combined and intelligent effort on the part of the fishing trade to be a producer, in large part, of the objects required for equipment, one can but feel that it would be to the advantage of American deep-sea fishing interests if something like it could be accomplished in the United States. But as the conditions referred to are largely due to the success which has followed the adoption of steam fishing vessels, it is scarcely to be expected that material change will occur in the American deep-sea fisheries until it is demonstrated that, for market fishing at least, steam-driven vessels are more profitable than sailing craft.

Observations on fisheries and fish markets.—The following notes on British fisheries and the methods of marketing fish are based upon studies and observations made in Scotland and England. They are far from exhaustive. It is not intended to make them so, but simply to invite attention to some salient features, the discussion of which at this time may prove helpful, in a suggestive way, to those interested in supplying our markets with fresh fish.

Aside from herring, nearly all the sea fish taken by British fishermen are marketed fresh, and whatever tends to improve the quality of the product and to make the supply nearly uniform at all times leads to greater appreciation of and reliance upon this kind of food and enhances the demand for it. It is scarcely necessary to add that success in commercial fishing depends on the creation of a demand for the products, the practical certainty of meeting with quick sales and getting remunerative prices. Whatever brings this develops prosperity, and the latter commands the services of the most skillful, courageous, and enterprising men. It is my purpose briefly to point out a few



ENGINEERING DEPARTMENT OF GREAT GRIMSBY COAL, SALT, AND TANNING COMPANY, LIMITED

things which seem to have brought about an unexampled period of prosperity in the British fisheries.

Existing conditions are doubtless due largely, if not exclusively, to improvements in putting fresh fish upon the market. While in Great Britain I had a purpose in eating fish, generally to test their quality. I ate them at hotels, in plain eating houses, at restaurants, at boarding houses, and in private families, and invariably found them in the best condition, with their natural flavors well preserved. I visited the fish markets at the fishing towns and in London and noted the condition in which the fish are marketed by the wholesale trade, and the retail markets of the metropolis were also subjects of observation. In all cases the result was satisfactory and the condition of the products, as sent to the retailer or delivered to the consumer, suggested the reason why the demand for fish exists. For it is evident that the sale of fish in the best possible condition creates a market for more, while every fish sold which gives dissatisfaction to the consumer decreases the demand for such food. This being conceded, the next thing to consider is the question of how present conditions in the British fish trade have been brought about.

Unquestionably the adoption of steam fishing vessels has been the prime factor that has made present conditions possible. It is true much was done by steam carriers to improve conditions before the advent of steam trawlers and steam liners. But while the former are still performing a valuable service in attending upon the fleets of sailing smacks and daily bringing their catch to market, the frequent independent trips of the steam liner and steam trawler have revolutionized the trade, and made possible what was before impracticable.

A rivalry also seems to exist between fishing ports regarding the quality of fish put upon the market, and this tends to good results, for the recognition of the fact that the trade of a place depends upon the reputation established for its goods impels all to use the utmost care and good judgment.

Of course when steamers—either trawlers or liners—make trips to distant fishing grounds, like those lying off the west coast of Norway, the Faroes, and Iceland, the fish must of necessity be on board several days before they are landed, and the first caught are not in such fine condition as when they can be marketed within a day or so from the time when they are caught, as is most commonly the case. It is, however, to be said that many, if not most, of the line steamers which make these distant cruises have wells in which the fish first taken can be kept alive. The last of the catch can then be iced, and will thus be comparatively new and in good condition when the vessel arrives, for the passage is seldom longer than three days. The trawled fish caught at the same time and place must of necessity be in a less desirable condition, for all are iced. Nevertheless, it is fair to state that vessels

resorting to these distant grounds usually fish a very short time, consequently it rarely happens that their fares are in bad order when discharged.

It is also true that the great bulk of the catch is taken comparatively near home, and the fish are marketed in the best possible manner.

Methods of trawling, etc.—In recent years the beam trawl has been entirely superseded by the otter trawl on steamers. The otter trawl covers more ground, fishes better than the beam trawl, and is easy to handle. The ordinary width of the mouth is 64 feet, which is 10 feet wider than the largest beam trawl. The otters are 8 feet long and 3 feet 6 inches to 4 feet high. There is little change in the construction of the trawl net, except in the size. The wings, belly, square, etc., are longer, but the "cod-end" is the same as in the beam trawl.

The otter trawl is well adapted to the capture of haddock and other free swimming species, which make up the bulk of a trawler's catch.

When fishing, a trawl is ordinarily towed about three hours. But while this is perhaps the time most commonly adopted, there is considerable variation, due to the character of the ground, the known or supposed plentifulness of fish, etc. If a good catch is made, the trawl on the opposite side of the steamer is shot as soon as one is up, and it is towed over the same ground unless the strength and trend of the current prevents. If, however, the result is unsatisfactory, the vessel generally steams away to a new position.

Trawled fish are usually gutted and packed in ice on shelves in the pens of the fish room. They are put in boxes for landing. If conditions permit, the fish are boxed between 5 and 8 o'clock on the morning of the arrival and put on the pier or "pontoon" for sale. With few exceptions, fish from trawlers are sold in boxes at Grimsby, but the line-caught fish, such as cod, halibut, etc., are laid out in rows, according to sizes and condition, and sold by the score, if there is a considerable quantity in a lot; otherwise they are disposed of by the piece, pair, or lot. The sales begin at 8 o'clock a. m. and continue until all fish are disposed of. Everything is sold by auction. While the sales are still going on the fish sold are rapidly packed in boxes, barrels, or other receptacles, and are promptly dispatched on swift trains to their destinations in various parts of the country.[1]

Long-line fishing.—The steam long-line fishery, however, seems to demand more attention here than trawling, for the reason that there is small probability of the latter immediately becoming a prominent feature of our fisheries, while the long-line or trawl-line fishery is already well established in the United States, although it is prosecuted

[1] See Report on the Beam-trawl Fishery of Great Britain for further details of trawling, marketing the catch, etc. U. S. Fish Com. Bull., pp. 209–407.

from sailing vessels and by an entirely different method from that in vogue in Great Britain.[1]

The steam liner *Phalarope*, one of the fleet of Mr. T. F. Robertson Carr, of Aberdeen, may be taken as a fair example of the first-class long-line steamers fishing from that port, although she is not so large and expensive as many of the liners from Grimsby, some of which are 120 feet long or more between perpendiculars, or about 130 feet over all. The *Phalarope* is 103 feet long. However, her equipment, the arrangement for the care of fish, and the methods of fishing prosecuted on her may be taken as typical, though of course there may be some local differences of outfit, and the exigencies of fishing, or individual opinions of different skippers, may cause some variation at times in fishing.

Fishing gear.—The lines used by the *Phalarope* are rigged for the capture of halibut, cod, ling, and various other species of ground fish which can be taken with hooks. The ground lines are hemp. They weigh 3½ pounds to the "cut" of 60 fathoms. The gangings or snoods weigh 1¼ pounds to the "cut." No. 12 Kirby-bend hooks are used.

The gangings are 2 fathoms long and approximately 4 fathoms apart on the ground line. The lines are rigged in "strings" of 60 fathoms each, and eight of these, with a total of 130 hooks, constitute a "basket" of line. The lines are coiled in large willow baskets, which have cork around one side of the rim for the hooks to stick into. The *Phalarope* carries 40 of these baskets of line, with 5,200 hooks, and an aggregate length of 20,200 fathoms, or considerably more than 20 miles of line.

The buoy lines do not differ materially from those of the New England fishermen. Hard-wood conical buoys are used. These have a long wooden staff going vertically through the middle, and usually fitted to receive a lantern at the top.

The "hook iron" used for disgorging hooks from fish, or killing them, is made of three-quarter-inch iron, 13 to 16 inches long, with a knob at one end, and with the opposite end flattened and split so as to fit over the bend of a hook.

For a part of each year herring nets are carried for catching bait. The season during which bait is taken by the line steamers is usually

[1] The exception to this is found alone on the Pacific coast, where steamers have been most profitably employed in the halibut fishery. These are owned or controlled by Eastern capital, but, nevertheless, the same men who have reaped profits from their Pacific ventures hesitate to invest in steamers for the deep-sea Atlantic fisheries. In recent years a few small steamers have found employment, more particularly in winter and spring, in beam trawling for flounders on certain sandy or muddy areas of sea bottom near the coast, especially in Cape Cod Bay and vicinity. It is said this fishery is reasonably remunerative, but the demand for flat fish is much less than in Europe, and there are no present indications of a marked expansion of this industry.

from March 10 to September 15. Sometimes herring nets are carried later in the season, and occasionally even to November, if the steamers are fishing on southern grounds, where herring are often found late in the year. In winter squid and herring are purchased for bait.

A line steamer will carry about twenty-five herring nets in summer. In Scotland sheepskin buoys are used for these, since they are very durable and tight, as well as cheap. They cost only about 60 cents each, and last from three to four years.

A yellow sheepskin net-float looks like a pumpkin. It is 12 to 15 inches in diameter; is first tanned and then tarred on the inside; the outside is usually coated with ocher. It has a wooden stock or staff in it, around the neck of which the skin is gathered and lashed so as to exclude water. There is a hole in the end of the staff for the buoy line to fasten into.

The stout warp which holds the nets to the vessel, when they are set, has a section of chain next the nets. This warp is called a "bush-rope" in Scotland.

Methods of fishing.—The method of fishing is as follows: The lines are shot from the vessel and hauled on board of her. Boats are never used for setting or hauling the lines. It is very severe weather when a steamer fails to set or haul her gear. Often the lines are shot, says Captain Forbes, of the *Phalarope*, when everything is afloat aft, where the men must stand to put them out. It is not uncommon for the deck to be full of water and baskets of trawl-line floating about, and it is often difficult in "coarse weather" for the men to keep their feet as the vessel rolls rails under or the short combing seas tumble on board.

When the lines are being shot, the vessel is kept at a speed of about 6½ knots and headed across the current, if the conditions are at all favorable for such a course. In some instances, however, when it is desirable to keep on a small patch of ground, the course may be changed, and less attention is given to the set of the tide. The object in placing the lines at right angles to the current is so that the snoods to which the hooks are bent will lay out clear of the ground line.

The lines are baited as they are set; three men are usually engaged in baiting the hooks, and one man "runs them out." A whole herring is put on each hook, particularly when fishing on soft bottom, and always when there is sufficient bait. Occasionally, when bait is scarce and the gear is put out on comparatively hard bottom, the herring are cut in two and a section is put on each hook. A whole herring is preferred for bait, especially on soft bottom, because of the abundance of the slime eel (*Myxine glutinosa*), which would soon strip the hooks if the herring was cut and leave small chance for the capture of cod, halibut, or other useful species. In baiting, the hook is passed through one eye of the herring and out through the back.

To shoot a long line, the buoy is first thrown over and the buoy

IRONMONGERY DEPARTMENT OF GREAT GRIMSBY COAL, SALT, AND TANNING COMPANY, LIMITED.

line run out; then comes the anchor to which the last end of the buoy line and the first end of the ground line are bent. The hooks are then baited and "run out," as already stated. Before one basket of line is out an end of the second basket is bent on, and thus the work proceeds until the whole string of gear is in the water, when the last anchor, buoy line, and buoy follow, and the ground line with its many baited hooks sinks to the bottom. No buoys or anchors are used besides those at the ends, except when a shot is made just before the steamer is going to market and when it is important to have the line sink to the bottom as soon as practicable, so that it may have more time to fish. Then a piece of metal, usually weighing 5 to 10 pounds, is bent to the ground line about three baskets from the last end thrown out.

After the line is out the steamer lies by the last buoy, keeping close to it, so that it may not be lost sight of. There is a lantern on the top of the staff, which enables the fishermen to keep track of the buoy during the night, and strict orders are given those on watch to keep the vessel in position. Indeed, this lying by the "dan," as the buoy is called, is a matter of the greatest importance to all, for the success of the trip, as well as the value of the gear, depends upon always being within sight of the light on the buoy staff. It is customary to lie by for about three hours. During this time a vessel usually steams against the current from one-half mile to 2 miles, according to the condition of the weather, when she stops and drifts back until she approaches close to the "dan," or passes by it, when she again heads the tide and gets into position. This is repeated until the time arrives to begin hauling the gear.

In the meantime those not on watch are sleeping. It is important to utilize every available minute for rest, for the men are compelled when at sea to be actively engaged in arduous work, even when the conditions are very severe, during the greater part of the twenty-four hours.

The best time of the day for setting long lines for cod varies with the seasons. In autumn more fish can be caught if the lines are shot in the evening, while in spring better results are obtained by putting them out late in the night or in the early morning.

The lines are hauled by night as well as by day, and under nearly all conditions of weather. In the fall and all through the winter fishing is prosecuted only at night, for day fishing would be unprofitable. Therefore, as stated, the lines are shot in the evening, and hauling begins some three hours later. In spring and summer day fishing is most successful.

The entire complement of gear is rarely set in winter. The quantity used depends largely on the condition of the weather, but it is seldom that more than 25 or 30 baskets of line are shot at a time, since at that

season it is deemed preferable to use a moderate quantity of gear and thus have a better chance of getting early to market, for in winter a steamer may market her catch three times a week, and exceptionally four times, while in summer, when she is fishing on more distant grounds, she may be able to make only one trip a week.[1]

In summer halibut constitute the most important part of the catch of steam liners from Aberdeen, but in winter skates are in demand and have been sold at good prices. Occasionally large financial results have been obtained by a vessel making exceptionally good catches of skates.

Care of the fish.—Ice is used both in winter and summer for packing the fish on board the steamers, and this is invariably ground fine before being taken on board, a custom practiced in all parts of Great Britain, where block ice is not carried on the vessels. About two tons of ice is usually sufficient for a winter trip, but the Aberdeen liners carry double that quantity in summer, and the vessels going on longer trips to distant grounds take a relatively larger amount of ice.

The ice is stowed in a section of the vessel's hold devoted specially to that purpose and called an "ice pound." This is usually forward of the fish room. A door leads from the ice room to the fish room for the convenience of the men in getting the ice, which, being all ready, can be promptly used. The fish room is subdivided into pens or bins, like the ice house of a New England market schooner, and these have sliding adjustable planks in front, so that they can be closed up gradually from below as they are filled with fish. They are also fitted with plank shelves or horizontal platforms, 8 inches apart,[2] upon which the fish are iced. Thus, after the bottom tier in the pen is stowed a layer of fine ice is put on the shelf next above, and the fish are laid on the ice, with ice between them, but no ice is put on top of them, except when the vessel is far from market, and it is not customary to lay one tier of fish upon another. Every possible effort is made to prevent the fish from having any appearance of being jammed, consequently when landed they look as if they had just been taken from the water.

The aim of the Aberdeen fishermen has been to put their catch on

[1]This applies generally, perhaps, but more particularly to the liners from Aberdeen, which fish in the North Sea or at the most not farther off than the Shetland Islands or off the Norwegian coast. The liners from Hull and Grimsby that go to the Faroes or to Iceland make longer trips. As has been explained, the latter are usually welled vessels and bring in a large percentage of their catch alive, consequently the fish are not affected by the length of the trip, while the condition of the fish in tight-bottomed vessels, like those under consideration at Aberdeen, is materially dependent upon the time they are in ice before being marketed.

[2]This was the arrangement on the *Phalarope*, and I understood substantially the same method is followed on other steam liners, and even on some if not all of the steam trawlers. The *Phalarope* carries about 45,000 pounds of fresh fish.

the market in the best possible condition and within as short a time as practicable after they are caught.[1]

Marketing the catch.—In winter the lines are usually hauled about 3 o'clock in the morning, and by 10 or 12 o'clock of the same day the steamer is in port and the catch is landed. In summer, when the vessels are working on more distant grounds, usually off the coast of Norway, it takes a longer time to reach the home market, but even then it is seldom that fish are more than twenty-four to thirty-six hours old when they are landed.

The fish are sold at Aberdeen, as elsewhere in Great Britain, at auction. Each vessel owner usually has a fish salesman to attend to the disposition of the catch of his steamers. There are also a number of men who assist in landing the catch and arranging the fish for sale, by placing them on the market dock in tiers or rows, according to grade, or in any other way required by the trade. As a rule, halibut are sold singly or by the pair; cod and ling are generally sold singly in summer, or by the score, half score, or quarter score in winter. Perhaps more are sold in lots of five than otherwise. The sale of skates varies with the supply and demand. One visiting the market can generally tell what the demand is, if he notes how skates are being sold whether by the score or smaller lots—for when the price is high they usually sell by fives or tens.

The fish auction at Aberdeen (as indeed in most of the British markets) is interesting and instructive, but more or less puzzling to a

[1] I think this is also true of other British fishermen, for, as has been explained, it seems to be a well-recognized fact that quality of fish is fully as important as quantity. In our American deep-sea market fisheries, however, almost the opposite is true, for our fishermen seem most eager for quantity and pay less regard to the condition in which the fish arrive, providing they are salable. Thus they are packed in pens in bulk, 4 to 6 feet deep, and generally without ice in winter. The result is that the underneath fish, lying under a pressure of tons, have a jammed and old appearance; their flesh is soft, especially if they have been caught two or three days, and they are quite unfit to bear transportation and added pressure. When they are finally brought to the consumer's table, perhaps two or three days after being landed, they have lost their firmness and flavor to a large degree, and are far less tempting, as an article of food, than they would be if properly cared for. The consequence is that the demand for fresh sea fish is much less than it ought to be, and undoubtedly much less than it would be if there were some intelligent regulations governing the care of such products, and the enforcement of them was strictly insisted upon by dealers. In no other way can a good market be created, for while every fish in first-class condition may create a demand for others, every poor or flavorless fish stops the sale of many of its kind. It goes almost without saying that our deep-sea market fishermen can not benefit themselves and the trade to the same extent in any other way as in giving the utmost thought to the care of their catch, for it is otherwise impossible for them to successfully compete with the products of the pound nets, seines, etc., along the coast, which are put on swift trains a few hours at most after they are taken

stranger. For one unaccustomed to it is generally at a loss to know how the bid of a buyer is indicated, for it is rarely announced in words. But the alert and trained salesman is on the lookout for a wink or a nod, or other signs, which the initiated know pass for bids, while the novice is surprised to hear the calls of bids by the auctioneer, when he is unable to determine what has been offered, or by whom, even though he watches closely. It seems to be part of the buyers' plans to conceal their identity with bids, so far as practicable, and I was told that a pull on the salesman's coat, or similar hidden signal, is often made to indicate a bid. It is all, however, intelligible to those accustomed to the trade, and the business is carried on very rapidly and much more systematically than one would expect who had never seen anything of the kind.

After the steamers reach market the gear is usually cleaned of old bait and made ready for use before they sail again. This process of preparing the apparatus is called "ridding"[1] the lines.

Unless repairs are needed, a steam liner rarely fails to go to sea again as soon as possible after landing her catch. For whatever the condition of the weather, rain or shine, blow high or low, she is off for the fishing grounds as soon as the fish are out and coal, ice, and necessary stores are on board. The storm that detains a fishing steamer in port must be exceptionally severe, for it is in bad weather when sailing craft can not go to sea that the steam vessel reaps her richest harvest, since prices then are high.[2] The fearless and hardy fishermen literally defy the elements in their sturdy steel and iron boats, and reck little of being half submerged much of the time. Thus, whatever the conditions, it is a warfare with nature, for it is "drive, drive, out and in."

Captain Forbes told me that often he has seen the high bow of the *Phalarope* go under a green sea when he was pushing her hard for market, and the water would go rushing like a cataract past the pilot house and out over the stern and rails. But there was never a thought of decreasing the speed, for "all is iron," and the contents of the fish room must be on the pontoon at Aberdeen next morning, whatever the risk or discomfort. The official zeal, courage, and endurance of these sea toilers are only equaled by their supreme confidence in the vessels they sail on. And this confidence can scarcely be wondered at, for

[1] Pronounced "redding."

[2] The unusually severe winter of 1898–99, when the North Sea was almost continuously swept by a succession of gales, proved the most profitable season for the Aberdeen steam liners they had ever known. One of the fleet of Mr. Carr, the owner of the *Phalarope*, secured a catch in twelve weeks that sold for nearly $5,000. This was largely due to the severe weather that made it impracticable for sailing vessels to successfully pursue their work at sea; hence the prices ruled high, and the steamers also made good catches.

these fishing boats rarely meet with serious disaster at sea, and actually pursue their hazardous work when much larger vessels are lost at sea or on the coast, or are compelled to seek shelter in harbor.

Lay and wages.—On the Aberdeen steam liners, settlements are made weekly with the crew. The method of payment is a mixed share- and wage system. The engineer, fireman, and cook are paid weekly wages and receive no share. The usual wages are £2 per week to the engineer, £1.6 to £1.10 to the fireman, and £1 to £1.5 to the cook. The cook, however, receives larger pay in summer, when nets are carried for catching bait.

All others are on shares. The system of settlement is as follows: The harbor and dock dues; commission to salesman, coal, ice, stores, and cook's wages are deducted from the gross stock. The net stock is then divided equally, one-half going to the vessel and the other to the fishermen, or those who receive no wages. The crew's half is equally divided among the men, the captain included, who receives no more than any other sharesman; sometimes, however, he receives a small bonus from the owners, particularly if he is a "lucky skipper," but this seldom exceeds £15, or about $75 per annum, and is usually about £5. Occasionally a master may be a shareholder in a fishing steamer, but this is not common on the liners.

From the vessel's half of the proceeds the engineer and fireman are paid; also a bonus of 1 shilling to the pound on the gross stock if it exceeds £40 per week. This is called the "stoker." The balance is the steamer's earnings.

The above method of settlement is limited to the season when bait is caught at sea by a steamer's crew. When bait is purchased it is deducted from the gross stock, and at that season the engineer and fireman's wages also are taken from the gross earnings. Thus, in winter, the sharesmen not only pay half the expense for bait, but also half of the wages for hired men.

Earnings of steamers. The earnings of fishing steamers vary materially, but my belief is that the variation is not so extreme as on sailing craft. The average profit has been large in recent years, as is plainly evidenced by the great amount of money being invested in this class of vessels. I was told that the net annual earnings were often half the total value of a steamer, and this, too, when the best sailing vessels can scarcely pay a dividend in the same fishery.

Occasionally large catches are made, but success is rather due to the uniformity of results than to lucky hits.

The largest trawlers from Aberdeen stock from $20,000 to $25,000 per annum—about what a vessel will cost when new. In 1898 one of these vessels stocked $2,650 in three weeks. When one considers the limited number of men carried by such a vessel, and the fact that a large percentage of them get comparatively small pay, the significance of

these figures, considered from the standpoint of investment, will be apparent.

A few years ago the *Phalarope* made what was then a record catch for a steam liner by landing 7 tons of halibut and several scores of other kinds of fish as a result of setting her lines once. Her fare sold for £209, or, approximately, $1,045. She was only four days at sea. Three years earlier the steam liner *St. Clement* landed a catch that sold for £214, but she was at sea fully a week.

A very large fare of halibut was landed in the summer of 1898, by the English steamer *Gaelic*. The fish were caught on a bank off the Lofoten Islands, on the northwest coast of Norway, some distance north of the Arctic Circle. It was reported that she caught 1,800 halibut in number. This was more than she had ice for, consequently the fish were below the standard when landed, and sold for a low price. It was stated that she stocked $2,500, but other accounts put it less.

The influence of all this has been shown in the development of the Aberdeen steam fishing fleet. Previous to 1881 Aberdeen was of comparatively little consequence as a fishing port, for it had only a few sailing trawlers, which met with indifferent success. But in that year the *Toiler*, Aberdeen's first steam trawler, went to work. At first the progress was slow. The innovation succeeded, but it took time to overcome prejudice and attain the best results. Then the advance was continuous, and to-day I am assured that the steam fishing fleet of this Scotch port numbers about 125 vessels, of which some 30 are liners and the rest fish with trawls.[1]

Sailing luggers at Aberdeen.—The Aberdeen fish market has grown with its fleet, and is now among the most important in the Kingdom. In addition to the steam fleet there are many Scotch luggers landing their catch here. These are of two general classes. One consists of about 80 to 90 single-masted, double-ended, clinker-built keel luggers, from 20 to upwards of 25 feet long. They are wide, deep, sturdy, seagoing boats that fish on nearby grounds and market their catch daily, and for part of the season may, perhaps, be employed in some other branch of the fisheries.

The other class is composed of the larger two-masted Fife and Zulu boats, ranging in size from 45 to more than 60 feet in length. These also are sharp-ended, clinker-built, keel craft, such as are commonly used in the Scotch herring fishery, but many of them engage in market fishing, especially when herring fishing is slack. They, too, fish near the coast, chiefly for small haddock.

It is extremely interesting to see a fleet of these boats coming in from sea and up to the market pier, locally called "pontoon," for their immense red lug sails add much picturesqueness to the harbor scene as

[1] Trawls are now used to a depth of 80 fathoms.

they sweep gracefully onward, and even under the impulse of the lightest breeze come gently into their berths at the dock. Sometimes, however, they are assisted by long oars, and these fall with regular cadence until the "pontoon" is near, when the rowing is stopped, the yards are lowered, and the great breadths of red and brown canvas fall in graceful folds on the deck as the skipper pilots his boat into the place selected for discharging her fare.

I saw many of these Scotch luggers at Grimsby, where they were landing their catch of herring, and their towering canvas lent variety to the marine picture, when at the opening of the dock gates on a morning, sailing trawlers, codmen, steam trawlers and liners, Scotch luggers, tugboats, and merchantmen headed out into the North Sea, each intent on the purpose of its voyage.

Grimsby docks and fish market.—At Grimsby the steamers are usually assigned positions in one part of the fish dock and the sailing vessels are by themselves. The docks are generally crowded, notwithstanding the bulk of the fleet is away at sea, and it is an instructive object lesson in the economic administration of great commercial fisheries to witness the landing of fish and the outfitting of this fleet that goes on daily.

The market, or so-called pontoon, stretches along the dock side for three-quarters of a mile. Here on a morning one sees fish of various kinds arranged for sale from one end of the market to the other (Pl. LXIX), and hears the loud calls of the strong-lunged salesmen who cry the merits of their goods and announce the bids received in no uncertain tones, however quiet and secretive the bidders may be. Unquestionably it is a great piscatorial bourse, wherein the bustle and activity of business during the hours when the sale is in progress are excessive, and can not fail to impress one who is not accustomed to such a scene.

But through it all it is well to remember that the supply of fish is generally uniform, despite the condition of weather and the uncertainties of the fisherman's life; that business is rapidly transacted, and that in the briefest practicable time tons and tons of fine savory fish are being whirled away on swift trains to various parts of the country.

Suggestions.—It appears to me that the deductions to be drawn from all this and applied to our deep-sea market fisheries are as follows:

1. Experience has shown that the most important and vital matter is to enhance the demand for fresh sea fish to the fullest extent possible. To accomplish this successfully the utmost care should be given to the preservation of fish on vessels[1] and the method of shipment, including an effort to secure the most satisfactory arrangement with the transportation agencies.

[1] It seems desirable to adopt the British method of icing fish on the vessels.

There should be a distinctive and determined effort to impress the fishermen with the importance of having a standard of quality, and that this should receive attention still more than quantity.

2. It is important that consideration be given to supplying the trade with living fish, and to this end welled vessels may be introduced with such arrangements for storage of the catch in live cars properly located in pure sea water as will secure to consumers the best possible article of fish food.

3. The introduction of steam fishing vessels, the use of which will be an important factor in securing the best quality of fresh fish and greater uniformity in the supply. It is probable such vessels, or at least those having auxiliary power, can be successfully used in the mackerel fishery, in which speed and the power to move in calms are important factors.

The advantages which might accrue to American fisheries through the introduction of steamers were indicated by me in "Suggestions on the employment of improved types of vessels," published in the United States Fish Commission Bulletin for 1888. The influence of invested interests and natural conservatism have combined, however, to prevent the employment of steamers in the North Atlantic deep-sea market fisheries. But in 1897 an iron steamer was built by Boston parties for employment in the Pacific coast halibut fishery. In general she resembles the fishing steamers of Great Britain, but is larger, being about 140 feet long. She sailed from Boston late in 1897, and arrived in Puget Sound on March 22, 1898. It was too late in the season to engage in halibut fishing, which is not profitable on that coast in summer, so the *New England* found employment in other directions, where she is credited with having made large profits.

A writer in the Fishing Gazette of April 29, 1899, makes the following statement concerning her success in the fresh-halibut fishery:

> She sailed from Vancouver, British Columbia, on October 4, 1898, and in six months and eight days she landed at Vancouver, British Columbia, 1,180,500 pounds of halibut, which were shipped to Boston and New York by the Central Pacific Railroad, and which made a net stock of $81,570.

This is believed to be essentially correct, and it is an object lesson that should not be lost. I have personally seen in Boston the halibut landed by this vessel, after they had been transported across the continent, and it is only just to say their condition was superior to that of halibut just landed from sailing vessels fishing in the Atlantic.

In view of all this it seems almost superfluous and unnecessary to suggest the employment of steam vessels for the betterment of our ocean fisheries. Still, while steam is practically sure to win its way if these fisheries are to be maintained on a paying basis, it is just as certain that conservatism will retard progress until it is finally

ON THE "PONTOON" AT GRIMSBY

Exhibit of Great Grimsby Coal, Salt, and Tanning Company, Limited.

demonstrated that sail-propelled vessels can no longer successfully compete in supplying our markets with an article of food the value of which depends upon its being in excellent condition when it reaches the consumer.

4. If anything can be done to bring the producer and the consumer nearer together in the matter of price, especially when the fisherman gets only a little money for his catch, it is easy to believe that both classes will be materially benefited and the trade in fresh fish will be much improved. It has been customary for retail dealers to sell at a uniform price, or at least to have little variation in their charges, even when the wholesale price has fluctuated largely. It seems to be an accepted belief that consumers could not understand why they should pay two or three times as much for fish one day as they were worth on the day previous, and that consequently the trade would be unfavorably affected by following the sudden and marked fluctuations of the wholesale trade due to a superabundance of fish or lack of adequate supply. Therefore it is deemed safest to keep the price uniform, despite the great disparity which frequently exists between the price received by the fisherman and that paid by the consumer.

Exactly what can be done to remedy this condition is a question that may well engage the attention of the most experienced and wisest men in the fish trade. It is, however, fair to assume that the employment of steam vessels may do much to change conditions in this particular, to the extent of making the supply more certain and uniform and thereby lessening the chance of extreme scarcity in the markets with corresponding inflated prices followed by an oversupply which can not be successfully and profitably marketed.

5. While the use of dories for setting and hauling trawl lines in weather when they can be used may be found most desirable in the Western Atlantic fisheries, the advantage which may be gained by operating gear from a steamer in rough weather, when boats can not be put out, is too obvious to admit of discussion. It is then that the adaptability of steam vessels to this kind of fishery is most apparent, for they can prosecute their work safely and successfully when our sailing schooners must lie by and wait for more favorable conditions of weather and sea.

Nor should the fact be lost sight of that with a steamer the time from the fishing ground to the market port is practically uniform and certain, whether it be against a winter's gale or in a summer's calm—conditions which delay the sailing vessel, however swift it may be with favorable winds.

While it is possible to invite attention to other phases of the fisheries which might be benefited by change, the most important suggestions derived from a study of British fisheries and fish markets have been indicated.

OTHER COUNTRIES.

Exhibits were made by private individuals and firms from several other countries which, like England, had no official representation. These were Germany, Belgium, Spain, and Italy.

The exhibits from Germany included nets and lines, canvas for sails, salt, zoological maps, seal and bottle-nose whale oil, and pearl shells.

A small display of fish glue and a collection of canvas for vessel's sails were exhibited by Belgium firms. The exhibit of duck by William Wilford was noticeable for a fine quality of cotton duck made in imitation of American canvas, and also for containing samples of duck made in the United States.

The only exhibit from Spain was salt.

There were two small exhibits from Italy. Both of these were made by Antonio Montini of Naples. They consisted of terra cotta and majolica models of fishing boats and samples of coral in the natural and manufactured conditions.

INTERNATIONAL FISHERIES CONGRESS.

An International Fisheries Congress was held in Bergen under the auspices of the exhibition, from July 18 to 21, inclusive. It was well attended, not only by Norwegians, but by men eminent in fisheries, fish culture, and science from nearly all European countries.

The meetings were held at the Bergen Museum, and papers were read for the first three days on various subjects relating to fish and fisheries. On July 21 an excursion was made on a steamer to the oyster-breeding establishment at Espevig, Tysnæs.

Among the papers read the following may be mentioned:[1]

"The fisheries of the United States," by Capt. Joseph William Collins.

"The distribution of Swedish fresh-water fishes," by Dr. Rudolph Lundberg.

"Respecting the basis for the development of the Norwegian fisheries and increasing their value," by Jens O. Dahl.

"The scientific investigations in Lofoten," by O. Nordgaard.

"The specific gravity of the herring and its relation to fatness," by Henrik Bull.

"The migrations of the herring and the periodicity of the European herring fisheries," by Frederick M. Wallem.

"Poisoning of rivers by naphtha," by Dr. Oscar Von Grimm.

"The duty on herring in Germany, Russia, and Austria," by G. Westergaard.

[1]These are given nearly in the order in which they were read.

"The French sea fisheries and the professional instruction of fishermen in France," by J. Pérard.

"The influence of whaling upon the other fisheries," by G. Sorensen.

"How can the sale of glue be made more profitable?" by Friman Kahrs.

"A possible connection between the codfisheries in Lofoten and those in Finmarken," by Dr. J. Brunchorst.

"Limitation of national territorial jurisdiction in the sea," by Hroar Olsen.

"The necessity of an international fisheries association," by Dr. K. Kishinouye.

"A permanent international committee for organizing international fisheries congresses," by J. Pérard.

"The duty on tinned fishery products," by Fr. Backer.

"English line and trawl fishing," by M. Barclay.

"The injurious influence of the seal on the fisheries, and how can it be prevented?" by G. Sørensen.

"On the fishing banks of the coast of northern Norway," by J. O. Dahl.

"The oyster ponds on the west coast of Norway," by Herman Friele.

Many of these papers were exceptionally instructive and interesting, since they embodied the best thought of authors who had enjoyed unusual opportunities to study the questions discussed. It was the purpose of those under whose auspices the congress was held to publish the papers read, and possibly others prepared for the occasion which could not be read for lack of time, but up to the completion of this report no information has been received of the publication of any of the articles. For this reason it is impracticable to present abstracts here of the more suggestive or instructive papers.

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